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GSR 2010 Discussion Paper

ICT Regulation in the Digital Economy

Work in progress, for discussion purposes

Please send your comments on this paper at: gsr@itu.int before 30 November 2010.

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1 ICT REGULATION IN THE DIGITAL ECONOMY

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1.1 Introduction

In this second decade of the 21st century, our focus is on the deployment of broadband and, more importantly, on broadband's transformative power as an enabler for economic and social growth in the digital economy. In turn, increased adoption and use of ICTs in the next decade and beyond will be driven by the extent to which broadband-supported services and applications are not only made available to, but are also relevant and affordable for consumers.

Take-up and usage patterns will vary widely among countries depending on the level of development and maturity of the market, what users—both individuals and businesses—demand, and how ICTs are positioned to enable such usage experiences. Numerous countries, such as Australia, Brazil, Hong Kong (China), Singapore, the United Kingdom and the United States, are currently engaged in highly visible public initiatives to facilitate the future development of broadband infrastructure and services; laying out comprehensive national broadband plans; and developing and implementing digital economy initiatives. Other countries, such as the Republic of Korea, have been involved in such initiatives for well over a decade now.

In developing countries, the shift from narrowband to broadband enabled IP-based services is likely to take place incrementally over the next decade and beyond. Factors such as technology, costs, digital literacy and, in particular, compelling content and applications that meet consumer preferences, will be key to this transition. Governments will be responsible for implementing adequate policies and regulations that allow and enable a broadband ecosystem to develop and take root as a means to support economic growth and social development. Taking into account the state of market development, governments must balance the need for targeted *ex ante* regulation to address foreseeable instances of market failure in the deployment of communications networks and services, while at the same time relying on market forces in areas within the ICT value chain where competition is likely to take hold. In doing so, governments must design ICT policies and regulation that accurately reflect the limits of market forces alone to deliver efficient outcomes that benefit consumers, as well as the way such limits may shift as the ICT sector evolves and matures. Governments should also take care not to impose burdensome and unnecessary regulation that may actually inhibit investment in broadband, impede competition, and limit the introduction of new networks, services and applications. Many of the successful deployments of new services and applications have been facilitated because they fall outside the regulatory regime or because regulators have opted not to regulate these services.

Beyond such limits, however, regulators and policymakers must strive to make the case for broadband and ICTs by bridging the access gap through universal access and service (UAS) initiatives and by engaging in possible public-private initiatives, where necessary, to finance infrastructure. Making the case for broadband and ICTs also involves stimulating demand for ICT services by adopting policies directed at making ICTs affordable for large parts of the population (e.g., low-cost terminals, and reduced taxation of ICT equipment and services) and promoting the creation of relevant and compelling content (e.g., developing digital literacy programs, e-government, e-health, and e-learning initiatives).

Network and service providers, on the other hand, must also make the case for broadband by offering services at the prices and with the features consumers demand. As voice-centric business models reach saturation, migration towards broadband services and ap-

plications targeting local needs will be necessary to maintain continued revenue generation and growth.

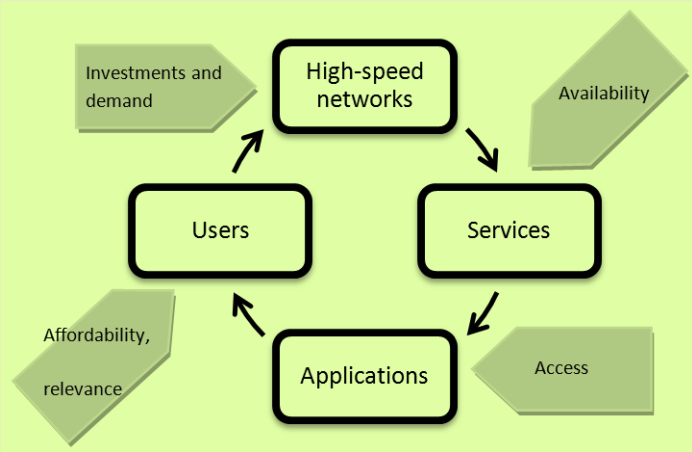
This paper charts the possible route regulators and policymakers can take to facilitate deployment of ICTs in the digital economy based on a multi-pronged approach. Section 1.2 describes the broadband ecosystem and underscores the need to adopt policies that address the specific reasons for non-adoption of ICTs within this environment. Section 1.3 highlights recent trends in the ICT sector, particularly regarding the shifts towards *ex post*, competition-based regulatory policies and targeted *ex ante* regulations. Section 1.4 examines the need for greater cross-sectoral cooperation and coordination among governments in order to achieve large-scale objectives, including promoting global e-environment policies and addressing transnational cyber security concerns. Section 1.4 notes how regulators, in expanding the notion of UAS policies beyond basic telecommunications services, are implementing provisions to promote both access to and adoption of broadband and ICTs in order to improve outcomes in every area of society, including education, healthcare and civic participation. Section 1.5 addresses how ICT regulators are coordinating with regulatory authorities responsible for other sectors, such as banking, the environment and health, to ensure that the benefits of ICTs reach all members of society.

1.2 Promoting Broadband Deployment and Use

1.2.1 The Broadband Ecosystem

In the digital economy, the provision of access to networks and services remains a critical issue. But the pervasiveness of ICTs, particularly the Internet, in multiple sectors of the economy requires that regulation be considered in a broader context. Issues such as the environment, data privacy and security, copyright protection, healthcare and education are all integrated within the broadband ecosystem. As shown in Figure 1.1, this ecosystem involves the multiple, interconnected layers of networks, services, applications and users.[1] In order to expand the broadband ecosystem, policymakers must continue their traditional focus on the supply of competitive access networks (*i.e.,* wireline and wireless broadband networks), as such networks continue to be the critical pipeline linking the other elements within the ecosystem. However, policymakers must also focus on facilitating the supply of, and promoting the demand for, broadband applications and services. Connectivity to broadband networks will increase demand for services and applications such as Internet Protocol television (IPTV) and Voice over Internet Protocol (VoIP), cloud computing and online video streaming. Governments must complement and build upon this demand by adopting policies that promote competition and innovation, as well as developing initiatives that encourage the public's engagement in ICTs, including e-government and e-health initiatives.

Figure 1.1: The Broadband Ecosystem



Source: Strategies and Policies for the Developing World, GICT, World Bank

Addressing the demand components of the broadband ecosystem requires new tools for policymakers, and should be grounded in a comprehensive diagnosis of the reasons for non-adoption of broadband and ICTs. Understanding the reasons for lack of adoption of broadband services will be essential for designing adequate policies to promote the development of broadband and ICT services over the next decade. Once non-adopters have Internet access available through either wireline or wireless networks, the cost of access and devices, digital literacy and relevance of services tend to be the main obstacles to becoming a subscriber. This is true in both developed and developing countries, as shown in Box 1.1 below.

Each country must analyze and address these factors on a case-by-case basis since certain impediments to adoption may be important in some countries, but less of an issue in other countries. For example, based on consumer surveys of non-users of Internet services in Brazil[2] and non-users of broadband in the United States,[3] Figure 1.2 below shows how some factors weigh more heavily than others. High costs are the main obstacle in both countries, although cost plays a larger role in Brazil than in the United States. By contrast, lack of access is a main factor for non-adoption for many more Brazilians than Americans.

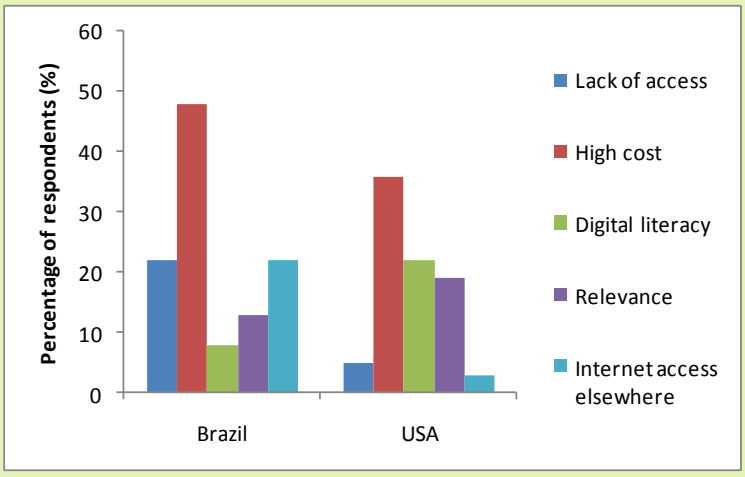
Box 1.1: Inhibitors to Adoption and Use of Broadband Services

The main inhibitors to adoption and use of broadband services include:

- **Lack of access**: Deployment of high-speed broadband networks is the first step towards increasing adoption rates. In Ghana, for example, one-fifth of non-users cite difficulty accessing the Internet as the main obstacle to adoption.
- **Costs**: Although non-adopters may have broadband connectivity available, they may not be able to afford either the cost of subscribing to broadband services or a computer, or both.
- **Digital literacy**: Some non-adopters can access and afford broadband service, but do not subscribe because they are unfamiliar with or uncomfortable using a computer or are concerned with the security of data and privacy online. In Kenya and Ghana, more than 50 per cent of non-adopters cite not knowing how to use the Internet as the main reason for non-adoption. The percentage of adults who do not know what the Internet is comprises 35 per cent of Ghanaians and 41 per cent of Kenyans.
- **Relevance**: Instead of, or in addition to, the above three factors, non-adopters may not be interested in the content delivered using broadband and consider the Internet to be a waste of time. In Ghana, of those who have used the Internet, more than half only went online for basic functions (e.g., email, news and search functions).

Source: Hannah Bowen, Africa Development Research Series: Ghana, InterMedia, (March 2010).

Figure 1.2: Reasons for Non-Adoption of Internet in Brazil and Broadband in the United States



Sources: NIC Brasil, Análise dos Resultados da TIC Domicílios and FCC, Broadband Adoption and Use in America.

1.2.2 ICT Adoption Rates are High, but Significant Disparities Remain

New technologies, services and applications are being deployed and taken-up by consumers at unprecedented rates. Mobile Internet adoption in the United States, for instance, has grown eight times faster than desktop Internet adoption in the first nine quarters after the launch of both services.[4] Mobile cellular service take-up has been a remarkable success story, with 2009 estimates of mobile penetration (*i.e.*, subscribers per 100 inhabitants) surpassing 100 per cent in Europe and the Commonwealth of Independent States (CIS) and reaching more than 30 per cent in Africa.[5] Wireless networks, particularly mobile cellular networks, are the most prevalent method for accessing communications and ICT services and applications in the world, with smartphones now driving the adoption of mobile broadband. By year end 2010, worldwide mobile cellular penetration will be nearly 60 per cent, with a ratio of 3.2 mobile cellular lines for each fixed line in service.[6] In developing countries, however, this ratio is even more skewed towards mobile cellular service. At year end 2008, the mobile-fixed line ratio was 66.9:1 in Kenya; 105.1:1 in Tanzania; 50.8:1 in Uganda; and 39.1:1 in Zambia.[7]

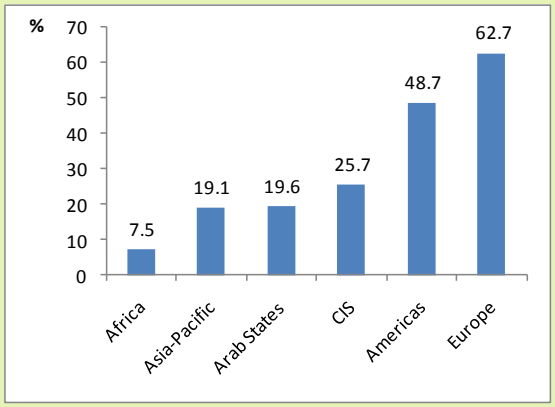
However, there still remain significant disparities in Internet usage between regions, with the International Telecommunication Union (ITU) estimating Internet user penetration in Europe being more than eight times higher than in Africa (Figure 1.3).[8] In developing countries, where in most cases wireline infrastructure is not widespread, mobile networks are the only viable access option available for large parts of the population. Not surprisingly, it is expected that wireless technologies will play, and in many cases are already playing, a crucial role in broadband diffusion in the next decade, with today's mobile voice users slated to be tomorrow's broadband users. To ensure that mobile networks are able to keep pace with demand from broadband users for applications and services, such as m-health and m-banking, the ITU and the World Bank have acknowledged the benefits of implementing spectrum policies that maximize the amount and value of spectrum available, particularly through the award of digital dividend spectrum and spectrum refarming, as well as flexible use spectrum policies.[9]

1.2.3 New Applications and Services Will Challenge Regulators and Policymakers

While ICTs are permeating the commercial and financial realm, the workplace, entertainment, and social interaction and networking, this is just the beginning. In the next decade, ICTs will pervade our day-to-day activities on a more significant level, providing an even greater breadth of applications and services -- many of which are not yet commercially available, or even conceived.

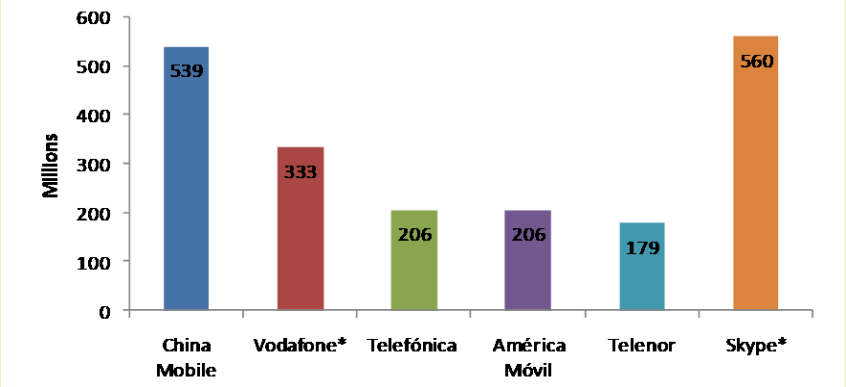
IP-enabled services and applications delivered by broadband networks will propel the digital economy in the next decade. For example, in only five years YouTube surpassed the two billion views a day milestone on a global basis. YouTube reports this is nearly double the prime-time audience of all three major free over-the-air television networks in the United States combined.[10] Similarly, if VoIP leader Skype were classified as a telecommunications carrier, it would be the largest "carrier" in the world based on registered users, controlling 12 per cent of world-wide international long distance traffic.[11] (See Figure 1.4)

Figure 1.3: Estimated Internet user penetration, by region, 2009



Source: ITU, World Telecommunication/ICT Development Report 2010

Figure 1.4: Top five mobile carriers by subscribers compared to Skype registered users (1Q 2010)

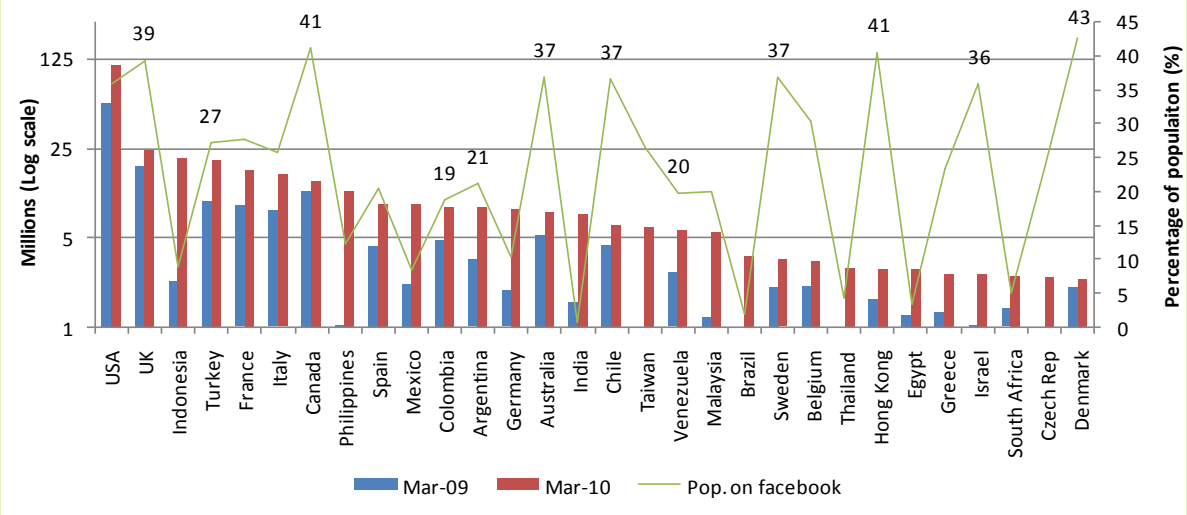


*Note: * Figures refer to 4Q 2009*

Source: Company reports, Telegeography, Morgan Stanley

At the same time, social networking sites are becoming more and more popular in both developed and developing countries. In fact, 15 out of the top 30 countries by number of Facebook users are developing countries. (See Figure 1.5.) Chile, for example, has a comparable number of Facebook users as a percentage of the population as more developed economies like Australia, Sweden and the United Kingdom, while Argentina, Colombia, Turkey and Venezuela also have relatively high usage. In addition, Facebook has expanded its focus, offering a wider range of services -- from communicating personal messages and "status updates" to exchanging content to gaming – which provides a broad user experience inside its pages. However, this expansion begins to raise a series of new regulatory issues (e.g., relating to data protection and privacy), and may subject such social networking sites to increased regulatory scrutiny, as is the case in the United States, Canada, and Europe.[12]

Figure 1.5: Top 30 countries by number of Facebook users



Source: Authors based on Nick Burcher, Facebook usage statistics - March 2010; Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision

This ICT-enabled environment also features stakeholders with global reach, a factor that presents potential new challenges for regulators and policymakers.[13] The promotion of ICT take-up in the next decade will continue to require enabling ICT regulatory environments. Policies will have to target the root of the large disparities in Internet use between developing and developed countries and, particularly, the deployment of broadband, as well as dealing with the issues raised by the new technologies and applications. As discussed below, policymakers are presently adopting a mixed approach that features a blend of targeted *ex ante* regulations aimed at fostering investment and deployment of networks and services and *ex post* rules to address anticompetitive conduct as technology and services converge.

1.3 Trends in ICT Regulation

As ICT markets become more competitive, regulators are beginning to transition from *ex ante* to *ex post* regulation. This is particularly true in the case of broadband markets, where the various links in the value chain may be subject to different degrees of competitive pressure. In promoting access to and adoption of ICTs, policymakers must consider whether to: 1) establish sector-specific, forward-looking regulation (*ex ante* regulation) to prevent or promote certain activities, or 2) establish or rely on competition law to remedy specific instances of anti-competitive behaviour (*ex post* regulation). Due to the fast pace of technological advances and an increasing recognition of the value of robust competition, policymakers increasingly have implemented *ex post* rules to foster innovative markets while imposing targeted *ex ante* regulation to address specific market failures, particularly with respect to the physical layer of the broadband ecosystem.

1.3.1 Targeted *Ex Ante* Regulation for the Physical Network Layer

Ex ante regulation is anticipatory in nature and directed toward situations where market failures are expected to occur.[14] The objective of *ex ante* regulation in the ICT sector is to adopt measures to prevent socially undesirable outcomes or to direct market activity towards desirable ends in light of the anticipated market failure.[15] Accordingly, *ex ante* regulation should be narrowly-tailored to address the specific instances of expected market failure. At minimum, the following three broad guidelines should be followed when considering the adoption of *ex ante* regulation: 1) regulation should reflect national conditions and goals; 2) regulation should first attempt to resolve market failure at the wholesale level; and 3) regulation should be periodically reviewed and phased-out when warranted. (See Box 1.2.)

Box 1.2: Imposing targeted *ex ante* regulation on the physical layer

- **Regulation should reflect national conditions and goals**

Different countries have different socio-economic, geographic, and political circumstances. In addition, their level of infrastructure development can vary widely. As a result, solutions to reach national goals that were effective in one country may not translate to another and must be tailored. Therefore, imposing *ex ante* regulation will require a fact-based assessment of a country's the market conditions and entails the collection, review and analysis of detailed information in order to attempt to accurately predict future behaviour and outcomes. *Ex ante* regulation should be targeted to address the specific problem(s) detected. A clear and accurate demarcation of the circumstances where market forces will not deliver desirable outcomes will be key to implementing targeted *ex ante* regulation in the coming decade.

- **Regulation should first attempt to resolve market failure at the wholesale level**

In liberalized ICT markets, any *ex ante* regulation should be primarily focused on wholesale services and facilities. Where a regulator identifies competitive concerns at the retail level, narrowly-tailored regulation of wholesale inputs identified as bottlenecks is generally preferred, allowing other links in the value chain of end-to-end services to be more responsive to the competitive process. This approach ensures that competitive concerns at the retail level are adequately addressed while also limiting *ex ante* regulation to those areas where the benefits to consumers cannot be achieved using *ex post* regulation.

- **Regulation should be periodically reviewed and phased-out when warranted**

The dynamic nature of ICTs requires regulators to monitor and periodically reassess competitive conditions in the marketplace. Technological changes can quickly impact the ICT market, displacing the rationale for *ex ante* regulation or shifting its focus towards other links in the ICT value chain. Periodic monitoring requires regulators to devote significant time and resources to reviewing and revising targeted *ex ante* regulation since static regulation may stifle innovation and investment. Given their resources, when adopting *ex ante* regulation, regulators should strike the right balance between safeguarding the interests of consumers and promoting long-term development of the sector. Although *ex ante* regulation may be necessary in the short term, the goal is to reduce *ex ante* rules as competition develops and, ultimately, for ICT services to be disciplined primarily by competition law.

Source: Telecommunications Management Group, Inc. (TMG)

Over the next decade, *ex ante* regulation will continue to be targeted at the physical infrastructure underlying broadband networks and may begin to address challenges in other areas such as services and applications. Consequently, regulations will likely focus to varying degrees on access networks, backbone, backhaul and international connectivity. The following sections address the importance of each of these links in the development of broadband networks and recent regulatory trends affectingeach one.

1.3.1.1 Access networks

Broadband access networks refer to the links between the exchange or node and the end user, which may be provided via cable, fibre, xDSL or wireless technologies(terrestrial and/or satellite). These links are generally referred to as the last-mile. The degree and extent of *ex ante* regulation of the access network, particularly on the wireline side, has varied significantly even among developed economies, ranging from a light-hand approach towards more extensive restrictions and obligations.

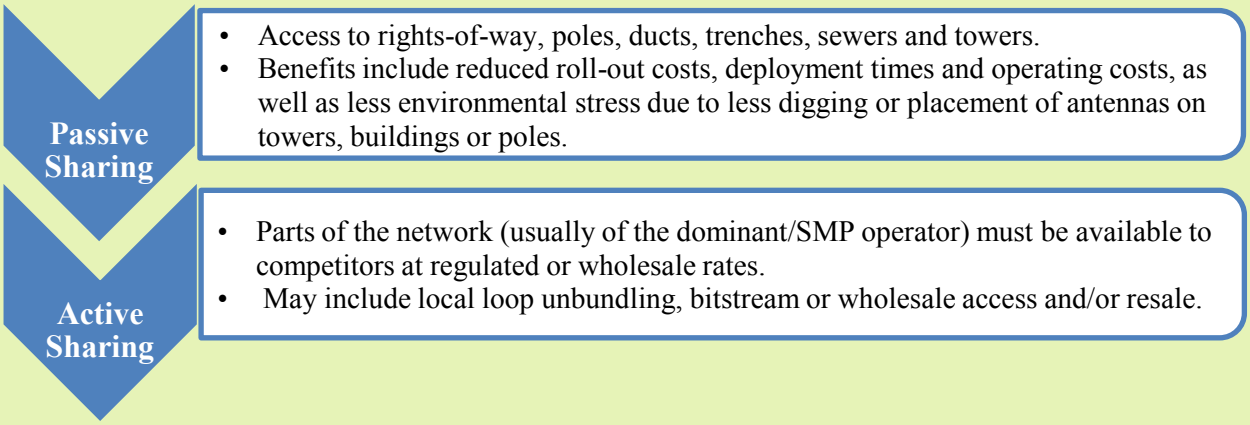
Wireline networks

Many countries, particularly in Europe, have adopted *ex ante* regulations focused on access networks to prevent large, incumbent providers from leveraging market power in ways that harm consumers through high prices and low quality of service. These regulations may include light-touch rules relating to sharing of passive infrastructure or more intensive obligations requiring active sharing, including sharing access node switches or unbundling the local loop.[16] Such approaches have been implemented in both developing and developed countries to encourage local access and competition, including Denmark, France, Japan, Korea (Rep.), the Netherlands, Nigeria, Norway, Saudi Arabia, Sweden, South Africa and the United Kingdom.[17] Although open access requirements began with legacy wireline networks (i.e., copper pairs), they are increasingly being applied to fibre broadband networks.

Wireless networks

The spectral efficiency of wireless technologies has increased by a factor of roughly 40 since the launch of second-generation (2G) mobile wireless services.[18] These technological advances, depending on country-specific market conditions, may allow wireless networks to compete against wireline technologies in the provision of broadband services for the first time within the next decade. In some countries, such as in Austria, Portugal and Finland, such competition has already emerged. (See Box 1.3.)

Figure 1.6: Passive and Active Infrastructure Sharing



Source: ITU

Box 1.3: Transformative potential of wireless in broadband-based competition: the case of Austria

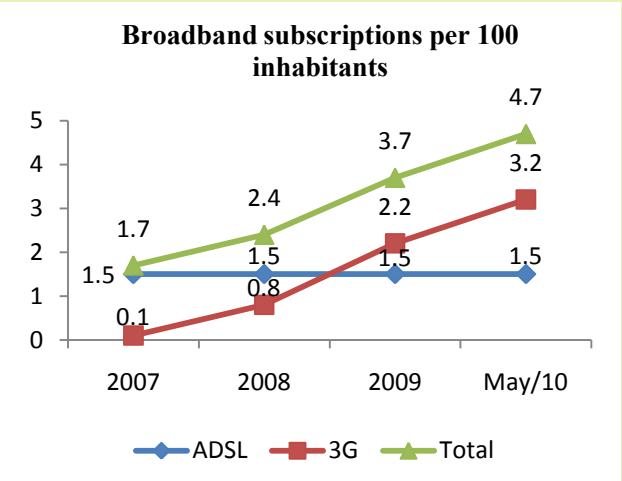
In 2009, the Austrian regulator (RTR) found that significant fixed-to-mobile substitution in the Austrian residential broadband market warranted withdrawal of ex ante regulation (i.e., bitstream access). In its wholesale broadband market analysis, RTR found that DSL, cable modem and mobile broadband connections are substitutes for residential consumers at the retail level. By including broadband connections over the three networks within the same relevant market, RTR determined that strong infrastructure-based competition – especially from mobile broadband – created a trend towards effective competition in the retail residential market for broadband service in Austria.

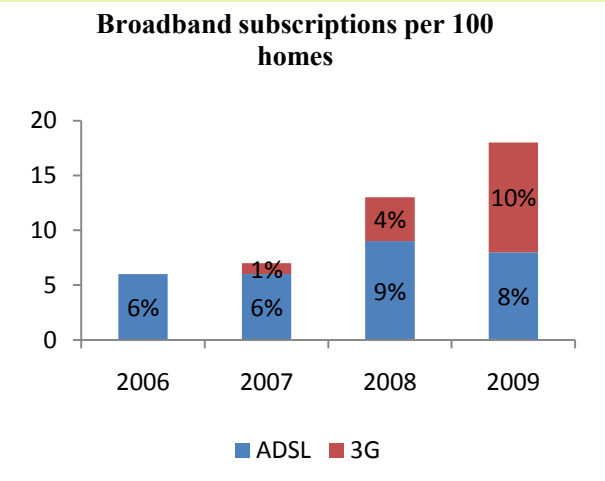
RTR noted that in Q1 of 2009, the total number of mobile broadband connections represented close to 35 per cent of all broadband connections, while DSL and cable modems represented around 40 per cent and 22 per cent respectively. For the period of 1Q2007-1Q2009, the mobile broadband growth rate was 19.6 per cent, outpacing the growth rate for DSL (3.4 per cent) and cable modem (0.7 per cent). RTR found that fixed and mobile broadband prices moved closely together, with fixed broadband providers directly reacting to price reductions implemented by mobile broadband providers Further, RTR found that pricing pressure from mobile broadband began reducing margins in 2007 for access-based competitors, leading to a decline in bitstream connections and the stagnation in ULL connections. Not surprisingly, RTR also found that 76 per cent of Austrian consumers (76 per cent) purchased stand-alone mobile broadband connections while only 24 per cent purchased it bundled with a fixed connection, indicating that consumers viewed both types of connections as substitutes rather than complements. In December 2009, the European Commission endorsed RTR's decision.

Source: RTR, Abgrenzung des Marktes für Breitbandigen zugang auf Vorleistungsebene, November 2009; EC, Letter of 7 December 2009, Case AT/2009/0970.

Over the next decade, in countries where wireline infrastructure is not widespread, wireless networks will play (and in some cases are already playing) a crucial role in broadband diffusion, particularly through third generation (3G) and fourth generation (4G) mobile services. In Morocco, for example, 3G connections surpassed fixed broadband connections (ADSL) in 2009, and by May 2010, more than doubled them (Figure 1.7, left). Most interestingly, mobile broadband accounts for almost all the growth in household penetration of broadband connections in Morocco (Figure 1.7, right).

Figure 1.7: Mobile broadband development in Morocco





Source: Michael Minges, Crafting a Broadband Strategy for Developing Countries an Evidence-Based, Case Study Approach, Telecommunications Management Group, Inc.[19]

Spectrum policies should facilitate wireless broadband deployments and should take into account the expected increases in data traffic that wireless services will generate.[20] As subscribers use wireless networks for broadband connectivity more intensely, throughput requirements will increase significantly not only on the access network, but also for backhaul and backbone connectivity. To support this expected increase in demand, regulators should implement policies that promote the most efficient and effective use of spectrum resources. Such policies include making sufficient spectrum available for broadband by freeing up spectrum bands that are either unused or underutilized. Policies for assigning spectrum should feature mechanisms that guarantee both that the resource will be held by the parties that will use it more efficiently and that important social objectives are achieved, such as the provision of connections to schools, hospitals and government offices and coverage of unserved or underserved areas. Similarly, flexible use of current and future commercial assignments should be considered as a means to facilitate technological evolution.

1.3.1.2 Backbone networks

Backbone networks refer to the high capacity communications facilities that carry traffic between at least two major nodes, and may consist of fibre optic, satellite or terrestrial wireless systems.[21] High capacity backbone networks are essential for broadband connectivity since they link access networks and ultimately end users. However, they require heavy investments. For example, the backbone of a typical mobile voice network represents approximately 10-15 per cent of the total network costs, with the costs of providing broadband substantially higher.[22] Increasing the number of users purchasing network service is one key way to defray the costs of deploying and operating a backbone network. This is typically accomplished by reselling capacity on backbone networks on a wholesale, non-discriminatory basis to downstream providers, which helps to establish competition across multiple tiers of service.[23]

One important issue that many regulators will have to address is related to vertical integration, where the backbone network providers are vertically integrated with the network operators, which results in a single end-to-end provider that can wield great market power. This is the case in many developing countries.The first step towards facilitating competition in vertically integrated networks is to ensure a liberalized market. In some countries in Sub-Saharan Africa, for example, mobile operators are prohibited from using the incumbent's network for backbone services, resulting in slow growth in broadband infrastructure.[24] The second step towards increasing competition may entail targeted, *ex ante* regulations requiring the backbone network provider to vertically disaggregate to various extents and offer network capacity on a wholesale, open access and non-discriminatory basis to competitors and ultimately to end users. In some cases, regulators have required carriers to separate their backbone operations from their access network (or retail) operations on either a functional or structural basis.

1.3.1.3 Backhaul networks

Backhaul refers to the links used to transport traffic from a geographically distant point, such as a wireless base station, to a significant aggregation point in the network, such as a mobile telephone switching office.[25] Since backhaul costs often constitute a significant portion of a network's operating costs, particularly for mobile operators, competitive and well-functioning wholesale markets for backhaul capacity are a critical component for broadband diffusion and ICT services deployment and take-up. Targeted *ex ante* regulation may therefore focus on establishing a framework for backhaul network sharing to ensure that competitors have wholesale access to backhaul capacity while guarding against possible anti-competitive conduct that can occur when operators share facilities. Backhaul network sharing can be achieved either through fibre cables or microwave links.

Developing countries are beginning to focus on core backbone and backhaul networks as a means to increase broadband deployment. South Africa, for example, established a state-owned, fibre-based infrastructure provider, Broadband Infraco, to provide national backhaul connections on a wholesale basis.[26] Brazil has also begun to focus on backhaul; it struck an agreement with five fixed-line operators to build out broadband backhaul networks to 3,439 unserved municipalities in exchange for being relieved of existing obligations to install 8,000 dial-up equipped telecentres.[27]

1.3.1.4 International connectivity

International bandwidth demand has increased significantly as ICTs, particularly the Internet, have been adopted more widely. Between 2002 and 2009, international bandwidth usage increased by 60 per cent, with the strongest demand growth taking place on links to Africa, Latin America and Middle Eastern countries.

Countries in these regions saw annual growth rates of over 74 per cent in this period.[28] However, adequate international connectivity is limited by gateways that can act as bottlenecks by restricting traffic flows and artificially increasing prices.

For those countries that do not have the benefit of competing infrastructure and well functioning international gateway markets, *ex ante* regulation may be warranted. Some countries, such as Singapore[29], India[30] and Colombia, have resolved instances of market failure through *ex ante* regulation imposing various obligations on the owners or operators of international gateways. In Colombia, for example, after conducting a review of wholesale inputs for broadband Internet access, the regulator found that cable landing stations constitute essential facilities and thus required landing station operators to provide access to their facilities on non-discriminatory terms and conditions and to publish a reference access offer.[31]

Self-regulation can also be a tool, in which consortium agreements contain non-discrimination and open-access safeguards to address potential problems stemming from absent or ineffective competition and regulation. Self-regulation was used in the case of the Eastern African Submarine Cable System (EASSy), a project to build a submarine fibre-optic cable that runs from South Africa to Sudan with connections to all of the countries along its route. Launched in 2010, EASSy, allows any of the consortium members to sell capacity in any market in the region to licensed operators on non-discriminatory terms and conditions, creating competition for the remaining members of the consortium.[32] A similar approach was used in the SEACOM system, launched in early 2009.[33]

However, contractual agreements alone may not resolve market failure where effective regulatory frameworks for competitive international connectivity have yet to be adopted or enforced. One example is the South Atlantic 3/West Africa Submarine Cable (SAT-3/WASC), which runs along the West coast of Africa. Despite evidence of increased market concentration, possible exclusionary practices and underutilization of the infrastructure, the relevant national regulatory authorities have not addressed the contractual agreements that guarantee exclusive control over and use of submarine cables and landing stations by members of the owning consortium, most of which are incumbent providers.[34]

In the long-term, liberalization and promotion of competition among and within facilities that provide international connectivity, in particular submarine cables and landing stations, is the best way to guarantee lower costs. For example, the 2009 landing of the SEA Cable System (SEACOM) that interconnects Kenya, Madagascar, Mozambique, South Africa, and Tanzania to undersea fiber optic with onward connections to India and Europe has resulted in Kenya Data Networks (KDN), a Kenyan data services provider, announcing it would "slash" Internet prices by 90 per cent.[35] However, liberalization may be more difficult in some developing countries, particularly those that are landlocked or isolated small island developing states (SIDS)[36] without access to submarine cables since they may have to rely instead on alternative technologies, such as satellites, which may carry a higher price premium.

1.3.2 Transition from *Ex Ante* towards an *Ex Post* ICT Regulatory Environment

Recognizing that the rationales for *ex ante* regulation no longer hold as markets mature and become more competitive, gradual fine-tuning or, in some cases, even full withdrawal of targeted *ex ante* regulation becomes necessary to better reflect competitive conditions in the market and serve consumer interests. When market conditions warrant the phasing out of *ex ante* regulation, regulators should consider, on a case-by-case basis, the need to establish sunset provisions or transition periods to ensure a smooth shift into an *ex post* regulatory environment. Transition periods allow stakeholders, consumers and service providers to gradually adapt to a new regulatory framework. Both the United Kingdom and Portugal, for example, adopted transition periods as they moved from *ex ante* forms of regulation to *ex post* regulatory frameworks. In May 2008, when reviewing the wholesale broadband access markets, Ofcom determined that British Telecom (BT) no longer had significant market power (SMP) in local exchanges where alternative services providers had emerged. In response, Ofcom withdrew certain regulatory obligations immediately (e.g., non-discrimination and transparency requirements), but required BT to provide existing customers network access for a 12-month transition period to afford BT's wholesale customers the opportunity to make alternative arrangements. Similarly, when reviewing the wholesale broadband access market in 2009, ICP-ANACOM found that Portugal Telecom (PT) did not have SMP in certain geographic markets and accordingly decided to withdraw *ex ante* regulation in such markets. Unlike Ofcom, the Portuguese regulator opted to maintain a 12-month phase-out period for most *ex ante* obliga-

tions imposed on PT in these geographic areas, including non-discrimination, transparency, access, cost accounting and financial reporting. The price control, however, was phased-out immediately upon the adoption of the decision.[37]

Finally, it is also possible that regulatory authorities may reinstate *ex ante* regulation (i.e., re-regulate). Although re-regulation is likely to be an exceptional measure, changes in expected market outcomes or even regulatory errors may justify such a measure.[38]

1.3.3 Relying on *Ex Post* Regulation to Address Anticompetitive Practices

Relying on *ex post* regulation to address competitive concerns in the ICT market requires the implementation of competition laws and regulations that are effective, enforced and suited to the country's specific conditions. This legal safety net is crucial for competitive forces to take root, but implementing *ex post* regulation may represent a major challenge, particularly for developing countries that lack competition laws and regulations or are affected by weak institutional structures. This challenge may be compounded where economic systems have traditionally relied on strong state intervention, resulting in entire sectors and most dominant firms being state owned, controlled by the government or afforded special protection by government policies.[39]

For over a decade, a series of initiatives have been implemented to create competition law frameworks in various countries around the world. Approximately 100 countries have adopted competition laws, with a quarter of those being developing countries.[40] Similarly, a series of regional initiatives have been adopted to establish competition law rules and principles, including in the Association of Southeast Asian Nations (ASEAN), in the Common Market for Eastern and Southern Africa (COMESA),[41] in the Economic and Monetary Union of West Africa (UEMOA),[42] in the Economic and Monetary Community of Central Africa (CEMAC), in the Caribbean Community and Common Market (CARICOM),[43] in the Andean Community (CAN),[44] and in the Common Market of the Southern Cone (Mercosur).[45]

Countries without general competition laws, such as the United Arab Emirates and the Kingdom of Bahrain, are beginning to develop ICT-specific *ex post* rules. In Bahrain, for example, the Telecommunications Regulatory Authority (TRA) plays the dual role of both regulator and competition authority for the ICT sector; the TRA introduced an ICT competition framework in February 2010.[46] Section 1.5 further discusses the role of and interactions between authorities responsible for enforcing *ex ante* and *ex post* regulation in the ICT sector.

1.3.4 Addressing Vertical and Horizontal Integration

In the technology-converged ICT environment, information technology firms not traditionally associated with the provision of telecommunications services or equipment are entering new lines of business that may result in vertical and horizontal integration. Apple, for example, began as a computer company and now offers various devices, such as the iPhone, that run a platform (Operating System - OS) that is tightly coupled with its vertically integrated business of media distribution through iTunes and Apple TV, as well as applications for mobile devices through the App Store. Similarly, Google began as a search engine and Internet advertising firm, but has branched into an array of roles including mobile communications device manufacturer, applications provider, an energy company and potentially a TV white spaces database administrator. (See Box 1.4.)

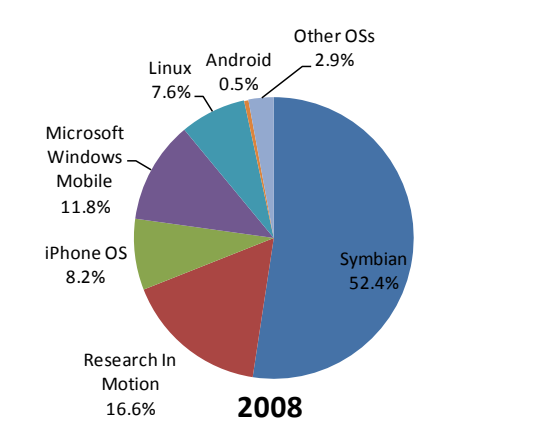
Although regulatory authorities have more typically focused on the potential anticompetitive effects of horizontal integration, vertical integration issues may become more prominent as technology convergence blurs the lines between markets. In reviewing both vertical and horizontal integration issues in today's converged and liberalized ICT environment, regulators will have to assess potential mergers on a case-by-case basis and analyze the merger's likely effects on the relevant markets. Necessary scrutiny should be given to integration while at the same time taking into account the highly competitive and fast-paced environment enabled by ICTs in order to avoid decisions that may stifle competition and innovation.[47]

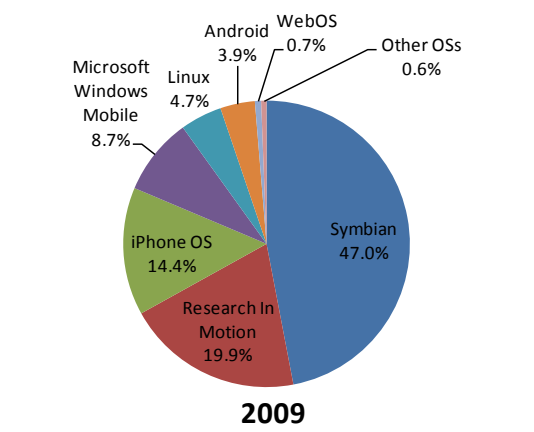
1.4 *Implementation of Cross-Sector Activities*

Since ICTs interact and intersect with every other major social issue and sector of the economy, including the environment, cybercrime and security, education, health and banking, governments must coordinate various interests in order to achieve large-scale objectives. Tackling ambitious cross-sector goals requires the coordination of the government authorities responsible for these sectors. It also requires regulatory frameworks broad enough to allow the ICT regulator to consider the relevant interrelated issues while remaining focused on promoting innovation and development in the ICT sector.

Box 1.4: Market shares of smartphone sales to end users by OS, 2009

In 2009, Symbian continued to lead the smartphone OS market, but its share dropped 5.4 per cent duet to competition from companies like RIM and Apple and weakness in Nokia's smartphone sales. The best performers in 2009 were Android (Google) and iPhone OS (Apple). Android increased its market share by 3.5 per cent in 2009, while Apple's share grew by 6.2 per cent from 2008, which moved it to the third position, displacing Microsoft Windows Mobile.





Android smartphones are expected to become the second-largest platform, after Symbian, by the end of 2010. Android's stellar performance, surging from 0.5 per cent market share to a projected 22.2 per cent in just two years, illustrates the highly competitive nature of this nascent ICT market.

Source: Gartner, www.gartner.com/it/page.jsp?id=1306513 and www.gartner.com/it/page.jsp?id=1434613.

1.4.1 ICTs and the Environment

Countries at all stages of development face environmental problems related to climate change, pollution, energy and decreases in biodiversity. ICTs can help to address climate change issues across the economy, particularly in the energy, construction and transportation sectors; ICTs can also improve water management techniques, protect biodiversity and reduce pollution.[48] ICTs impact the environment in positive ways, such as by allowing online delivery of information, telecommuting and video conferencing.

Despite the many ways in which ICTs can reduce the impact of human activity on the environment, ICTs also contribute to global greenhouse gas emissions and the production of electronic waste ("e-waste"). For example, the rise of broadband-enabled devices using "always on" connections and increased processing capabilities will require greater amounts of energy in order to power these devices.[49] The rapid pace of innovation and technological change has resulted in more frequent replacement of electronic devices, which has created enormous amounts of e-waste as mobile phones, computers and other devices are quickly discarded and replaced with newer devices.[50] Policymakers around the world are increasingly examining new approaches to ICT policies and regulation in order to capitalize on the ways that ICTs can facilitate better environmental stewardship, while minimizing the negative impact of ICTs on the environment.

1.4.1.1 ICTs and climate change[51]

ICTs are a necessary part of monitoring the effects of climate change.[52] They are also essential for the monitoring systems of weather forecasting and climate observation, as well as for predicting, detecting and mitigating the effects of natural disasters.[53] Furthermore, ICTs provide important remote sensing capabilities for climate and weather monitoring.[54] The data provided by ICTs are then used for computer modeling to show the effects of climate change on the environment. These data can also be processed through grid computing, which relies on broadband networks to connect scientists and allows them to draw on data resources distributed around the world.[55] Grid computing provides small and remote research institutions with access to the newest environmental data and also encourages networking and virtual collaboration.[56] As shown in Box 1.5 below, ICTs can also help to reduce greenhouse gas (GHG) emissions and contribute to positive environmental change in a variety of ways.[57]

Box 1.5: Ways that ICTs can reduce GHG emissions

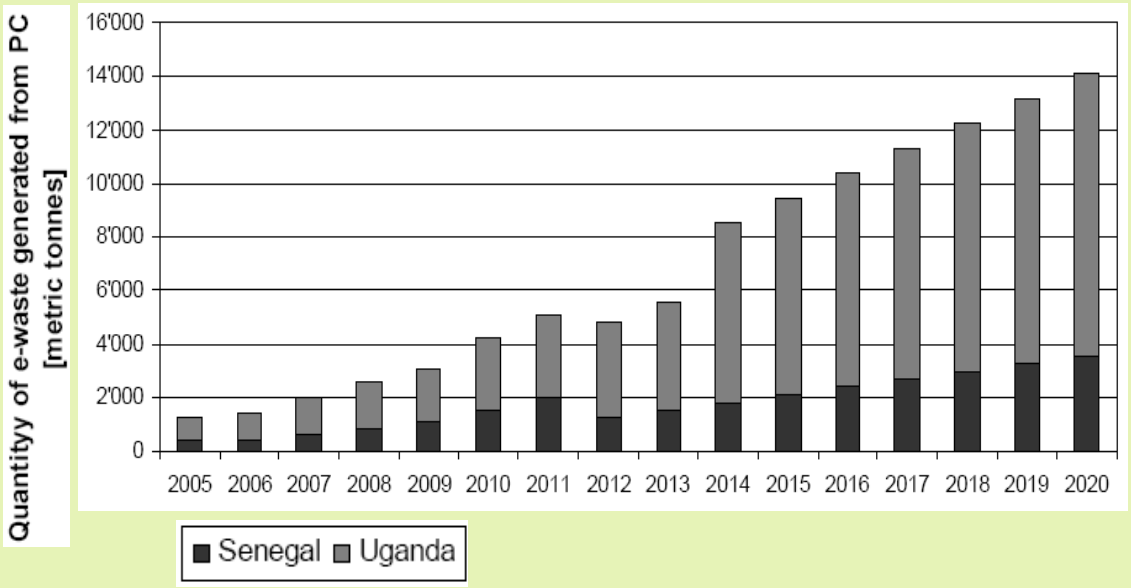
- ICTs increase information flow and networking and can reduce duplication of activities across and between organizations;
- ICTs allow for a systematic approach on local, regional and international levels in order to deal with complex, multidisciplinary issues such as the environment;
- Web services can save energy and reduce GHG emissions;
- Free and low-cost web-based applications help developing countries save financial resources, which can be put towards green initiatives; and
- More energy efficient devices lead to lower GHG emissions.

Source: ITU, ICTs for e-Environment: Guidelines for Developing Countries, with a Focus on Climate Change

1.4.1.2 E-waste

Rapid technological changes in the ICT sector, rising incomes and falling prices for electronic products have resulted in a seemingly endless number of new electronic products with many economic and social benefits. However, the proliferation (and short product cycles) of these devices also creates a problem as they are discarded; they become electronic waste ("e-waste"). This can be a particular problem for developing countries where recycling facilities may be less developed.[58] Although approximately 53 million tons of e-waste was generated worldwide in 2009; only 13 per cent of it was recycled.[59] To compound the problem, the production of e-waste is growing by about 40 million tons per year.[60] By 2030, developing countries will discard 400 million to 700 million obsolete personal computers each year as compared to 200 million to 300 million in developed countries.[61]

Figure 1.8: Quantities of e-waste generated from PCs in Senegal and Uganda, 2005-2020



Source: UNEP, Recycling—From E-Waste to Resources

Given the growth of e-waste, it is essential that policymakers implement effective legal frameworks that control both legal and illegal trade in, as well as the generation of, e-waste with active participation from governments and the private sector. Regulatory measures, such as stricter environmental regulations and recycling requirements, have been introduced in a number of countries to prevent or minimize e-waste. For example, the European Commission passed directives in 2003 that impose stricter rules on Member States, as well as set targets for consumer participation in recycling programs. Directive 2002/96/EC on waste electrical and electronic equipment ("WEEE Directive") developed rules to reduce e-waste and to promote the reuse, recycling and recovery of e-wastes. In Sweden, e-waste laws are largely credited with making the country one of the global leaders in e-waste recycling.[62] Sweden has placed the responsibility for the collection and disposal of e-waste on the producers of electronic devices, known as "Extended Producer Responsibility" (EPR). Sweden implemented a national e-waste registery in 2007, and requires all electronic device manufacturers to register, to report the quantities of products sold as well as to report the percentage of devices that have been collected and treated.

In April 2010, the Indian government drafted the E-Waste (Management and Handling) Rules, which would incorporate EPR as a basic principle (similar to Sweden), placing the burden on the producer to track the life cycle of devices.[63] Additionally, India's E-Waste Rules would ban the import of used electronic devices for charity, a measure similar to the Ban Amendment of the Basel Convention.

1.4.1.3 Domestic ICT and environmental policies: Towards green ICTs

Governments around the world have begun adopting various initiatives to address the environmental issues highlighted above, including programs to increase environmental research and development (R&D), promote "green ICT" innovations and develop e-environment skills through consumer and business education. Government-sponsored programs to increase R&D activities are among the most common initiatives, particularly for creating energy efficient ICTs. Japan, for example, established the Green IT Project to encourage collaboration between industry and academia in order to develop energy efficient ICTs.[64] With an annual budget of JPY 3 billion (USD 32 million), the initiative has focused on reducing energy consumption by over 30 per cent in several areas, including in network components such as routers and data storage centres and through high-efficiency cooling systems and digital displays.[65]

Policymakers are also adopting other comprehensive "green ICT" plans to increase green ICT skills and to develop public awareness about the role ICTs play with respect to climate change. In Egypt, for example, the Ministry of Communications and Information Technology (MCIT) adopted the *Green Information and Communication Technology (ICT) Strategy* in August 2010. The program involves several initiatives, including: forming a private/public sector task force that will conduct ICT-related education workshops and seminars, holding training programs to build green ICT skills in Egypt's workforce, and raising awareness of the roles that ICTs can play in reducing GHG emissions from all sectors of the economy and preserving natural resources.[66] Rather than implementing these initiatives alone, the MCIT has partnered with the Ministry of Environmental Affairs through a Memorandum of Understanding.[67] As addressed in Section 1.5.3 below, ICT regulators and environmental agencies around the world are increasingly working together to accomplish their goals more effectively.

1.4.1.4 International efforts to promote ICTs and environmental initiatives

Cooperation among countries, including conducting multi-country studies, implementing regional initiatives and capacity building, is important to capturing the greatest benefits from green ICT initiatives due to the cross-border effects of climate change and other environmental issues. For example, a recent study by the Organisation for Economic Co-operation and Development (OECD) analyzed 92 green ICT programs sponsored by governments and industry in 22 OECD countries plus the European Commission. The report confirmed that both the public and private sectors have adopted a range of ICT and e-environment policies addressing research and development (R&D), innovation, green ICT initiatives and education on ICTs and the environment.[68] The OECD countries passed a recommendation in April 2010 calling for member countries to establish or review their policies for ICTs and the environment.[69] Details of the OECD Recommendation are highlighted in Box 1.6 below.

Box 1.6: OECD recommendation on ICTs and the environment

The key areas for member countries to address in reviewing ICTs and the environment include:

- The coordination of ICT, climate, environment and energy policies in order to assess the direct effects of ICTs on the environment and enable ICTs to positively affect other sectors.
- Support for research and innovation in green technologies and services, particularly for "smart" applications.
- The promotion of green ICT-related education, training and skill development to meet demand for environmental skills and expertise at all levels and in all industries.
- Methods to increase public awareness of the role of ICTs in improving environmental performance, which includes the widespread development and adoption of clear standards and eco-labels based on life cycle approaches to production, use and disposal of ICT goods and ICT-enabled applications.
- Approaches by which Governments can lead by example and minimize the environmental impact of ICTs in public administration through green ICT approaches, applications and services.
- The setting of transparent policy objectives and targets to measure and improve government green ICT strategies, including ICT-enabled applications across the economy.
- Private sector engagement to foster support for e-environmental issues since the private sector will implement many of the green initiatives.

Source: OECD, Recommendation of the Council on Information and Communication Technologies and the Environment

1.4.2 ICTs and Cyberthreats

1.4.2.1 Growth in ICTs and cyberthreats

The expansion of ICTs into every aspect of our lives, including shopping, banking, water and electricity supplies, social networking, health care, education, traffic management and commerce, leaves us increasingly vulnerable to cybercrime. Cybercrime is often described as "any activity in which computers or networks are a tool, a target or a place of criminal activity."[70] In order for people to enjoy the many benefits of an interconnected world, they must feel confident in the security of the networks, services and applications they use. Policymakers must therefore seek to protect legitimate activities against four broad categories of cybercrimes: 1) offenses against data privacy and the integrity of computer systems, such as illegal access and data interference; 2) computer-related offenses, such as cyber theft and fraud; 3) digital piracy and copyright violations; and 4) content-related offenses, which may include illicit content, online gambling, libel and cyber bullying.[71]

1.4.2.2 Technology-related offenses

The first two types of cybercrimes listed above – data privacy and computer-related offenses – are technology-related offenses most often associated with cybercrimes. These offenses include hacking, remotely deleting information through viruses and system interference through computer worms or denial-of-service attacks.[72] In 2008 alone, data theft and cyber security breaches cost businesses as much as USD 1 trillion globally due to losses in intellectual property and expenditures for repairing the damage from breaches.[73] With revenues from cybercrimes exceeding USD 100 billion in 2007, which was more than the worldwide illegal drug trade, the lucrative nature of cybercrime means that cybercrime will only continue to rise without concerted global action.[74]

Cyber security is important to protecting infrastructure, as well as protecting individuals' data privacy. However, there are both technical and legal challenges to preventing technology-related cybercrime and to minimizing cybercrime's detrimental impact. Challenges include the growing reliance on ICTs, which means that even short interruptions in service can result in great financial damages. Additionally, the ubiquity of Internet access increases the number of targets for cybercrime, and makes it easier for offenders to escape identification.[75] The sheer volume of information, users and devices adds to the difficulty of tracking and locating cyber criminals.

1.4.2.3 Digital piracy

In the digital age, copyright violations have soared due to illegal downloading and file sharing, which have particularly affected the music and movie industry. An estimated 95 per cent of all music downloads world-

wide are illegal[76] and revenues from global music sales have declined about 30 per cent between 2004 and 2009, representing billions in lost sales.[77] To combat these problems, countries are increasingly considering the imposition of heavy penalties and fines against those who download copyrighted material illegally, as well as requirements that Internet service providers (ISPs) assist in identifying illegal downloaders and in enforcing anti-piracy laws.

One measure that has gained worldwide attention is France's anti-piracy law, *Création et Internet*, which came into effect in January 2010.[78] Known as the anti-piracy "three strikes" law, it requires ISPs to send suspected digital pirates two warnings about their illegal downloading activities. After the third suspected offense, the downloader is required to appear before a judge who can impose a fine of up to EUR 300,000, impose jail time or suspend Internet access for up to a year. Infringers are also put on a "three-strike" blacklist to prevent them from acquiring Internet service through another ISP. Proponents of the law state that it will stop or curb illegal downloading of music, movies and other copyrighted materials, and in turn promote artistic expression by protecting the creator's copyright in the work.[79] Opponents state that the law will not lead to a decrease in illegal file-sharing because there are numerous ways to circumvent the limitations set out in the law, for example by streaming video rather than downloading it. Instead of deterring copyright violations, they believe the law puts innocent users in danger of being penalized due to hackers using their IP addresses to download materials illegally. Other European countries have also passed anti-piracy measures, including Sweden[80] and the United Kingdom.[81]

At the international level, more than a dozen countries are negotiating the Anti-Counterfeiting Trade Agreement (ACTA). The ACTA negotiations are headed by the United States, the European Commission, Switzerland and Japan, and have been joined by Australia, Canada, Jordan, Korea (Rep.), Mexico, Morocco, New Zealand, Singapore and the United Arab Emirates.[82] ACTA would: 1) focus on cooperation among the signatories to address the challenges of cross-border illegal trade in copyrighted materials; 2) establish a set of enforcement best practices that are used by authorities; and 3) create a legal framework of enforcement measures. Countries would enforce the legal framework through a new governing body existing outside of international institutions such as the World Trade Organization (WTO), the World Intellectual Property Organization (WIPO) or the United Nations. Proponents argue that ACTA is necessary to curb the increase in global illegal trade of copyright-protected works, while opponents argue that ACTA may harm consumer privacy, innovation and legitimate commerce.

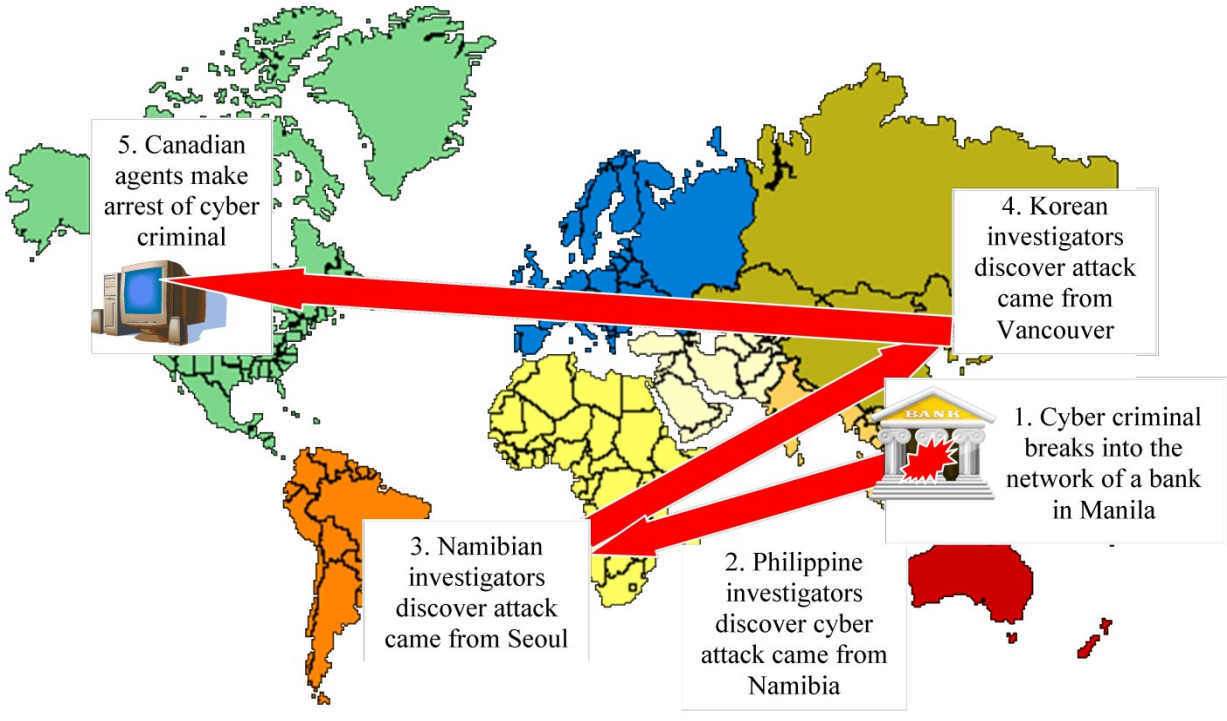
1.4.2.4 Content-related offenses

Whether content-related activity is regarded as a criminal offense or protected free speech is highly dependent on each country's cultural and legal frameworks. Although child pornography is generally criminalized in all countries, other content-related conduct is not. For example, the distribution of "racist and xenophobic material to the public through a computer system" is a crime in the European Union,[83] but would likely be protected speech in the United States.[84] Religious defamation is another example of content-related cyber activity that is illegal in many Arabic countries, but is not criminal in the United States or in some European countries. Given the differing legal standards for the regulation of content, it is unlikely that international frameworks will emerge. Instead, these issues will continue to be addressed on a country-by-country basis, or perhaps through regional initiatives in areas with similar cultural backgrounds.[85]

1.4.2.5 Globalization of cybercrime

Cybercrime often extends across national boundaries, such as when illegal content is stored outside a country or viruses are transmitted through a number of countries during the transfer from sender to recipient. An increase in cybercrime, including theft and fraud, is a negative side-effect of connecting more than 1.8 billion Internet users worldwide.[86] Cybercrimes have become highly globalized because they can be committed against Internet users anywhere in the world. A cyber criminal can force law enforcement agencies into a virtual chase around the world by using any number of techniques that mask the identity of the cyber criminal and make tracing communications difficult, particularly the use of anonymous communication servers that encrypt transmissions, as shown in Figure 1.9[87] Since the criminal never meets the victim, the anonymity of cybercrime has also resulted in a new breed of tech-savvy criminal.[88]

Figure 1.9: Hypothetical example of cybercrime involving multiple countries



Source: Adapted from U.S. Department of Justice, International Cooperation in Cybercrime Investigations.

Cyber criminals often enjoy impunity by working from countries with weak or non-existent cybercrime legal frameworks. Further, due to the speed with which electronic theft and fraud occur, law enforcement may not be able to catch cyber criminals even in countries with strong cybercrime legislation. Legal difficulties often arise due to a lack of international cooperation. Even for those countries with existing mutual legal assistance agreements, the processes for sharing information are often formal and time-consuming.[89] It is therefore necessary to set up procedures that facilitate cooperation between countries in order to be able to respond quickly to cyber threats. At present, however, cybercrime will continue to offer high rewards and low risks to criminals until there is effective national legislation and international frameworks capable of effectively investigating, prosecuting and punishing cybercrimes.

1.4.3 ICTs and Education

Leveraging ICTs to promote education can bring significant benefits to multiple societal groups, including students, educators, and adult members of society at large. For over two decades, countries have been implementing a vast array of plans and policies to integrate ICTs and education, with this trend increasing in many developing countries in recent years. Initiatives include the use of multiple technologies and services to extend the reach and expand the scope of educational systems, including the use of traditional media such as radio and television and newer technologies such as computers and the Internet. The use of media such as radio and television has been highly effective in some settings due to their nearly ubiquitous penetration; the use of computers and the Internet has proven to be capable of transforming the educational experience. Such initiatives are often the product of collaboration between multiple actors, including governments and the private sector, as well as donor agencies and non-governmental organizations.

1.4.3.1 School connectivity

Improving and expanding connectivity for educational institutions are often key components of national development plans, and are closely tied to national ICT plans and policies. A 2007 survey carried out by *info*Dev found that among 48 African countries that had or were developing a national ICT plan, 39 had or were also developing plans for ICT in their education sectors.[90] A number of countries have also adopted national strategies, policies and targets for school connectivity, often reflecting international and regional initiatives. For example, a 2009 survey conducted in the

Caribbean region found that regional initiatives, such as the Organisation of Eastern Caribbean States (OECS) Education Reform Unit's (OERU) *Model ICT policy for the education system*, had been used or were being used to develop national ICT policies in education in six countries in the region.[91]

School connectivity initiatives and strategies vary between countries and even within countries.[92] The recent toolkit launched by the ITU - *Connect a School, Connect a Community* - provides a wealth of examples of school connectivity projects and experiences around the world, including: [93]

- Establish special programs to implement connectivity for specific schools (e.g., Chile's The *Enlaces* (Links) program, created in 1992 and administered by the Center for Education and Technology within the Ministry of Education in Chile[94]);
- Involve top-down and bottom-up methods (e.g., Namibia's *SchoolNet* project);
- Bring together development partners and new technologies (e.g., *the Macedonia Connects* project, established in 2004 as a partnership between the Ministry of Education and Science (MoES), the United States Agency for International Development (USAID) and a local ISP called on.net.); and/or
- Subsidize Internet access tariffs for schools (e.g., the United State's Universal Service Fund Schools and Libraries Program, known as *E-Rate*).

1.4.3.2 Dissemination of Computer Devices

Governments around the world are contemplating and implementing pilots or programs to distribute low-cost computer devices (LCCDs) to schools. The term LCCD is a relative one, given the income and development differences around the world. Nevertheless, LCCDs are generally associated with the idea, developed by then-MIT Lab researcher Nicholas Negroponte, of an inexpensive laptop for every child in the world.

To reduce costs, national strategies for LCCDs in schools have taken two main approaches: (i) computer labs, and (ii) one-to-one computing. (See Table 1 for the advantages and disadvantages of each approach.) Traditionally, many governments have promoted "computer labs" in schools as a means to extending ICTs in education and also to reduce expenses. Labs are shared locations or classrooms within schools where a limited number of computers are available for use by multiple students. Indonesia, for example, launched the "One School One Lab" program in 2003, aimed at expanding the availability of computer labs in its educational institutions. A recent *info*Dev study on ICTs and education in India and South Asia found that most government initiatives involve providing computer labs to schools, particularly secondary and higher secondary.[95]

Box 1.7: Portugal's *e-escola* (e-school) and *e-escolinha* program[96]

Portugal has launched two successful LCCD dissemination projects – the *e-escola (e-school)* program and the *e-escolinha* program.

- The e-school program, which was initiated in June 2007, distributes laptops with broadband Internet access to teachers and secondary school students. By September 2010, the program had distributed over 450,000 laptops to students throughout the country. The laptops are sold by telecommunications providers at EUR 150, with a EUR 5 discount over the basic monthly fee for the 3, 5 and 7.2 Mbps broadband connections. Reduced fees are available to lower-income students, who get the laptops free of charge and obtain broadband connectivity at 3 Mbps for between EUR 5-15 per month. E-school is subsidized from the fees mobile operators paid for UMTS (3G) licenses.
- In July 2008, the Portuguese government in partnership with Intel, also launched the *e-escolinha* project to produce a Portuguese version of the Intel Classmate (the "Magalhães"). The project calls for distributing this computer to 500,000 primary school students; by September 2010 over 410,000 computers were distributed. Parents pay a fee for the computer, based on their economic situation (ranging from EUR 20 to EUR 50) with no fee imposed on low-income households. Portuguese mobile operators offer both pre-paid and post-paid mobile broadband Internet plans with EUR 5 per month discount as well as wireline broadband connectivity for the Magalhães at discounted prices.

Sources: See Escalões da Acção Social Escolar (ASE) at http://eescola.pt/e-escola/oquee.aspx.

A second, more recent strategy has been to reduce the ratio of students to computers, with the ultimate goal being one computer per student. The LCCD movement is geared towards this objective through initiatives such as "One Laptop per Child" (OLPC). OLPC initiatives have been launched in numerous countries, including Afghanistan, Portugal, and Uruguay. In Uruguay, *Plan Ceibal* was launched in December 2006 with the objective of providing all primary school students with their own laptops. Its success was facilitated by the political commitment from the President of Uruguay, Tabaré Vázquez, and necessary funds, some USD 21 million in 2007, equivalent to 2.7 per cent of the total budget for education in Uruguay. By December 2009, a total of 371,073 laptops had been distributed to public primary schools and 6,000 to secondary and private schools and the Institute for Children and Youth of Uruguay.[97]

As computer costs decrease, it becomes more affordable for countries to distribute them widely in schools.[98] However, while the one-to-one approach is attractive, and has been achieved by countries like Uruguay, it is nevertheless an expensive proposition. Costs include not only the price of the computer devices themselves, but also transport, distribution, maintenance and training, among others.[99] Given the high cost of providing each student with their own laptop, this may not be a feasible short-term approach for many developing countries. A more practical strategy may be a mix of approaches. Countries like Chile, for example, have progressively worked to achieve one-to-one computing. The Chilean *Enlances* program has been credited for dropping the ratio from 70 students per computer in 2000 to an expected 10 students per computer in 2010.[100]

Table 1.1: Pros and cons of the one-to-one computing and computer lab models

	Pros	Cons
One computer per student (laptops)	• Can be taken home and shared with family • Creates sense of ownership with less theft and damage • Some designed for developing country rural environment (e.g., handle extreme temperatures, low battery use, etc.) • Some designed for children (e.g., rugged, ergonomic) • Some include educational software and ecosystem of support • More democratic in that all children receive computers	• Relatively Expensive • Can be disruptive
Computer labs (recycled computers, thin clients)	• Less disruptive than one-to-one model • Computer lab more economical than one-to-one • More practical for shared settings such as computer labs or community centres • Generally more powerful than laptops	• Higher maintenance and support since likely to be different • Students spend less time with computer • Labs may not be equitably distributed throughout school system or computers can be dominated by certain students

Source: ITU, Connect a School, Connect a Community Toolkit of Best Practices and Policy Advice for Connecting Schools, Module 2: Disseminating Low-Cost Computing Devices in Schools, www.itu.int/ITU-D/sis/Connect_a_school/Modules/Mod2.pdf

Box 1.8: School connectivity checklist: Issues to consider when developing initiatives[101]

Due diligence related to school connectivity plans

- Ensure consistency with policies to promote overall ICT connectivity within the country.
- Coordinate plans with policies, strategies, and programs for universal service, as well as broadband and digital and Information Society agendas.
- Set key parameters to guide and implement the connectivity goals and targets early.
- Conduct inventory of school infrastructure and existing connections to assess potential for connectivity and need for different connectivity models.
- Identify potential funding sources, which may include governments, operators, multilateral or bilateral assistance and private sector sources.
- Identify appropriate Internet connectivity technology or technology mix to provide an appropriate balance between available bandwidth and lower up-front and recurring costs.
- Develop specific "ICT for education" plan with proper focus and detail devoted to school connectivity, with feasible and fundable targets.
- Consider negotiating agreements with operators to obtain preferential prices for educational facilities.
- Consider subsidized Internet access as a tool to meet universal access goals, with broadband connected schools serving as the enabling connection points.
- Consider connectivity needs of special populations, such as women and girls, persons with disabilities, indigenous peoples, rural or under-served populations and others with special needs.
- Consider potential of using schools with Internet points as regional "hubs" or "anchor points," to extend broadband connectivity to other communities.

Key players

- Ministries/agencies responsible for education and for ICTs and ICT regulator to ensure that universal service funds/obligations are included within the plan and roles of all are fully determined.
- Private sector and non-governmental organizations (NGOs) to help advance school connectivity.

Regulatory issues

- Consider allocating spectrum for educational broadband; reducing or waiving spectrum fees for academic institutions; and/or allowing use of unlicensed spectrum for broadband connectivity.
- Consider including specific conditions or requirements for the education sector in network licences.Regulatory authorities may need to modify licence conditions to include education-focused requirements.

Monitoring and Evaluation

- Include methods to evaluate the technical results of Internet connectivity, measure progress towards school connectivity and analyze the impact of broadband access on learning.
- Employ monitoring and evaluation for both new deployments and upgrades from narrowband to broadband connectivity.

Source: ITU, Connect a School, Connect a Community Toolkit of Best Practices and Policy Advice for Connecting Schools, Module 1, www.itu.int/ITU-D/sis/Connect_a_school/Modules/Mod1.pdf

1.4.4 ICTs and Health

ICTs are able to significantly improve the quality of life for many around the world when used in the field of health and medicine, particularly for populations in remote areas, as well as those with limited mobility. With the advent of broadband connectivity and more sophisticated technology, there is greater potential for ICTs to improve health outcomes through e-health initiatives, particularly in rural communities. E-health involves a variety of services and tools, including electronic health records and telemedicine (see Box 1.9 below).[102] For

developing countries with high mobile penetration rates, mobile health initiatives hold particular promise for providing high quality health and medical services to unserved and underserved populations. Considering that there are fewer than 27 million doctors and nurses for the more than six billion people in the world—and only 1.2 million doctors and nurses in the lowest income countries—harnessing mobile technologies is becoming essential for healthcare practitioners to reach patients.[103]

1.4.4.1 Connectivity is key for e-health initiatives

Although basic voice and data connections are useful to improving health and medical care, broadband connectivity is necessary to realize the full potential of e-health services. For example, broadband connectivity is necessary for telemedicine that enables real-time audio and video communications between patients and doctors, as well as between healthcare providers. Improvements in telemedicine and other e-health initiatives rely on increasing bandwidth capacity, more storage and processing capabilities and higher levels of security to protect patient information.[104] Basic fixed and mobile infrastructure is insufficient to take advantage of the e-health opportunities in the digital economy. Ensuring access to and adoption of fixed and mobile broadband networks is necessary to including those who have been left out of more traditional healthcare models.

This was the case in Rwanda where a three-phase e-health project was delayed due to lack of high-speed broadband connectivity.[105] During the first phase of the initiative, an electronic data storage system that permitted sharing of patient information among three hospitals was established. This phase was completed without delay. However, the final two phases involving video conferencing and a real-time telemedicine system were put on hold for a year until a broadband Internet connection could be established to connect the three hospitals with a fibre optic cable network.[106]

Examples such as Rwanda where hospitals and medical clinics are being connected with fibre networks, show it is possible for these facilities to act as anchor institutions that serve as "jumping-off" points for the further provision of Internet connectivity into communities. Policy makers should encourage arrangements that allow medical facilities or their partners to resell excess capacity in order to both extend connectivity and provide some level of financial support for the broadband link.

Box 1.9: Examples of e-health tools and services

- **Telehealth/telemedicine**: The use of ICTs either to support the provision of health care or as an alternative to direct professional care. This enables healthcare professionals to diagnosis and treat patients remotely, as well as allowing for radiology and laboratory information to be sent electronically.
- **m-Health**: Enables the use of mobile devices to collect health data and to provide healthcare information to practitioners, researchers, and patients, as well as real-time monitoring of patients and direct provision of care via mobile telemedicine.
- **Electronic health records**: Allows immediate communication of patient data among different healthcare professionals and includes information such as test results, medication and general clinical history.
- **Education and training for healthcare practitioners**: Enables doctors and nurses to continue their training and provide the most up-to-date technologies and services to patients.
- **Decision support systems**: Automated or semi-automated systems that support decision-making in a clinical environment.
- **Education and awareness**: Use of electronic resources by patients or healthy individuals to research various health topics.
- **Geographical information systems**: Applications allow healthcare professionals to aggregate and analyze data over local, regional, national or global areas, which can support disease surveillance, public health advisory systems and vaccination status reporting.

Source: WHO, eHealth Tools and Services: Needs of the Member States, Report of the WHO Global Observatory for eHealth (2006).

1.4.5 ICTs and Banking

Increased penetration and use of ICTs has great potential to extend access to financial services to low income households that are not reached by traditional bank branch networks and also to lower the cost of delivery to both banks and customers.[107] In emerging markets, there is on average one bank branch and one automated teller machine for every 10,000 people, but more than 50 per cent of the population has access to a mobile phone.[108] For these markets, the deployment and take-up of mobile banking services (m-Banking) is of particular relevance. Connecting the "unbanked"[109] through mobile phones would introduce millions to financial services that will help build assets and make the poor "less vulnerable to crises so that they can ultimately plot their own paths out of poverty."[110] This potential of m-Banking signals the increased convergence of two industries: ICTs and financial services, a trend that is expected to continue to increase in the coming decade.

In countries, such as Afghanistan, Kenya, Indonesia, Pakistan, the Philippines and South Africa, various forms of m-Banking services are expanding the financial services frontier. These services allow users to make payments and remittances, access existing bank accounts, conduct financial transactions, engage in commerce and transfer balances, for example. (See Box 1.10.)

Two main models of m-Banking have developed over the last few years: (i) bank-based and (ii) nonbank-based. In a bank-based model, customers establish a direct contractual relationship with a prudentially licensed and supervised financial institution, even though the customer may only deal with agents (*i.e.,* nonbanks) that carry out transactions on behalf of the bank. In a nonbank-based model, on the other hand, the customer does not have a direct contractual relationship with a prudentially licensed and supervised financial institution. Rather, the customer exchanges cash at a retail agent for electronic value (*i.e.,* e-money) that is recorded in a virtual account on the server of a non-bank, such as a mobile operator or an issuer of stored-value cards.[111] (See Figure 1.10 below.) While this distinction is useful in delineating the two different models, ultimately even nonbank-based models rely on banks, as the money collected from the public must be intermediated by a bank under the full purview of prudential regulation and supervision.[112]

For example, m-Banking services such as Zain's (now Bharti Airtel) Zap service in East Africa are already starting to defy this classification, falling in a possible hybrid category where collaboration between banks and mobile providers is tighter.[113] Similarly, in some jurisdictions where regulation requires bank-based models to be implemented, mobile providers have opted or have been required to acquire a controlling stake in financial institutions to launch m-Banking services. This is the case of Pakistan, where Telenor Pakistan acquired 51 per cent of Tameer Microfinance Bank and together entered into a partnership agreement to launch the *easypaisa* service.

Box 1.10: Various types of m-Banking services

m-Banking refers to a variety of services, and we use the term in a broad sense here. Services can be broadly summarized as:

i) m-Transactions and m-Payments, which refer to financial transactions (remittances and payments) made using a mobile phone without visiting a financial institution;

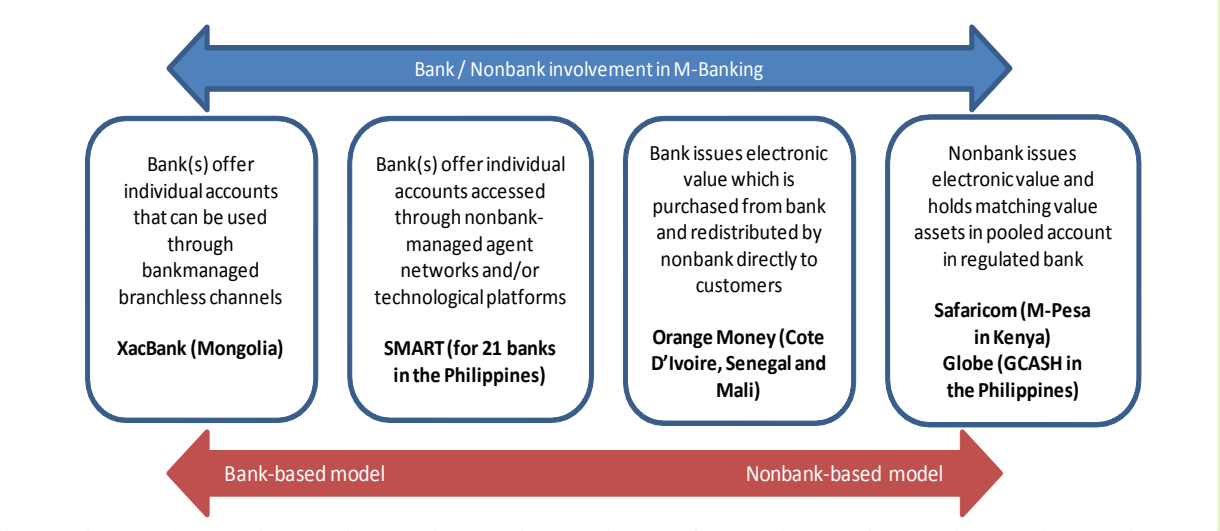
ii) m-Banking which involves financial institutions in cooperation with mobile operators offering a channel to an existing bank account. The service is both transformative in targeting the unbanked, (e.g., those who do not have bank access or bank accounts) and additive by targeting those who already have bank accounts and providing an extra means of accessing the bank account;

iii) m-Commerce, sometimes called u-Commerce given its ubiquitous nature, which refers to the buying and selling of goods and services through wireless handheld devices such as mobile phones; and

iv) Airtime transfer or balance transfer, which is a person-to-person transfer of the electronic value that has been purchased for purposes of making phone calls or sending text messages within one network.

Source: Johan Hellström, The Innovative Use of Mobile Applications in East Africa, Sida Review 2010:12 (May 2010) at www.sida.se/publications.

Figure 1.10: M-Banking models



Source: Adapted from Michael Tarazi and Paul Breloff, Nonbank E-Money Issuers: Regulatory Approaches to Protecting Customer Funds, CGAP Focus Note No. 63 (July 2010) at www.cgap.org/gm/document-1.9.45715/FN63_Com.pdf

There are notable examples of success stories of m-Banking in developing countries. In Kenya, M-pesa by Safaricom, launched in March 2007, has handled over KES 130 billion (USD 1.7 billion).[114] It has nearly seven million registered customers transferring an average of KES 150 million (USD 1.96 million) per day, mostly in small amounts of approximately KES 1,500 (USD 20) per transaction. M-pesa customers can visit more than 10,000 merchants who act as "agents" for account opening and handle deposits into and withdrawals from the customer's virtual "wallet." Customers can use their mobile phones to check bank balances, pay bills and purchase airtime.[115] In Pakistan, *easypaisa* was launched in October 2009 and supports a full portfolio of financial services, including loans, deposits, transfers and payments. By July 2010, it had reached more than two million customers, with PKR 4.8 Billion (USD 55 million) having passed through the system. Perhaps more interestingly, 65 per cent of *easypaisa* transactions are from people who are neither Telenor Pakistan nor Tameer Microfinance Bank customers, further fostering financial inclusion.[116]

m-Banking presents certain regulatory challenges, however, as banking laws and regulations often were not designed to incorporate the possibility of such services. Accordingly, there is often a need to adapt banking regulations to facilitate m-Banking. This is evidenced by the case of Peru. Peruvian regulations currently permit third parties, such as mobile operators, to deliver banking services as an agent of a licensed banking institution, subject to the banking regulator's authorization.[117] Although some banks provide access to Internet banking through mobile phones for pre-existing customers, there is no relevant mobile banking business in Peru due to stringent regulations that include a prohibition on opening an account outside of a bank branch.[118] Since only 26 per cent of Peruvians use banks, the banking regulator, the Superintendence of Banks, Insurance and AFP (SBS), announced in May 2010 that it will introduce new regulations to allow full-service mobile banking services.[119] By introducing this regulation, SBS aims to reach the 80 per cent of Peruvians who use mobile phones and to create "electronic money" companies to promote access to financial services for the unserved.[120]

Box 1.11: Relevant financial regulatory issues to be addressed to enable development of m-Banking

The following are areas where sharpened regulatory analysis would result in a better balance between maximizing the opportunity of m-Banking models and mitigating their risks:

- More flexible branch regulations that permit banks to manage more differentiated customer sales and service models, based on the transaction types and volumes performed.
- Banking agent regulations that permit banks to engage third-party retail outlets as cash merchants, with minimal financial risk for both banks and their customers.
- Consumer protection regulations that help customers understand and act upon their rights in a more complex service delivery chain, without burdening banks with unnecessary provision.
- Tiered Know Your Customer (KYC) regulations that permit immediate account opening with minimum barriers for poor people, with a progressive tightening of KYC as their usage of financial services grows.
- Creating regulatory space for a class of non-bank e-money issuers authorized to raise deposits and process payments, but not to intermediate funds.

Source: Claire Alexandre, Ignacio Mas and Dan Radcliffe, Regulating New Banking Models that can Bring Financial Services to All.

1.5 Cooperation among Regulatory Authorities in Different Sectors

Due to the influence of converged ICTs on all other sectors, ICT regulators are in a special position to ensure that the benefits of ICTs permeate throughout the economy. This section addresses how governments have expanded the role of regulators to better address the convergence of telecommunications, broadcasting and information technology. In addition, it examines how most telecommunications and electronic communications laws recognize the ICT regulators' expertise by granting them the authority to decide matters broader than ICT-specific issues, particularly regarding competition. Finally, it looks at how ICT regulators must either decide these broader ICT-related issues independently or in cooperation with other regulatory entities, as well as how these decisions affect regulations in other sectors of the economy addressed above, such as the environment, health, and banking.

1.5.1 Expanding the Regulator's Mandate

In most countries, the telecommunications/ICT regulatory authority operates separately from the broadcasting and video content regulator. However, nearly 30 countries have chosen to establish a converged ICT regulator by expanding the role of the telecommunications regulator to include authority over broadcasting, content (e.g., video programming) and Internet services. The rationale for this trend is that a converged regulator is better able to adapt and respond to an environment where distinctions based on services and networks are becoming blurred. With a converged regulator, service and consumers are able to look to a single agency for all matters relating to the communications sector. Countries with converged regulators include Australia, Finland, Iraq, Italy, Japan, Kenya, Mali, Malaysia, South Africa, Singapore, Uganda, United States and United Kingdom.

Despite this trend, most OECD countries still have separate regulators for broadcasting and for telecommunications. Additionally, content regulation is typically addressed by a separate ministry or government authority (e.g., in India and Saudi Arabia) or by the broadcasting authority (e.g., in Botswana, Chile and Colombia). For example, in India, there are two entities responsible for content regulation. The Ministry of Information and Broadcasting monitors content related to broadcasting and film while the Ministry of Information Technology regulates content related to the Internet.

1.5.2 Expanding the ICT Regulator's Mandate to Include Competition Matters

If jurisdiction over competition matters is delegated to an ICT regulator, other challenges may arise depending on whether or not the country has a set of general competition laws and a separate regulator to handle these issues. For countries without general competition laws, the electronic communications laws or regulations are likely to expand the mandate of the ICT regulatory authority to guard against unfair or anticompetitive conduct. For countries with regulatory authorities overseeing general competition laws, the challenge is to establish rules clarifying how overlap-

ping jurisdiction will be handled in order to avoid conflicts between agencies.

1.5.2.1 Expanding the ICT regulator's mandate to address competition

For many countries without a long-standing competition law framework, liberalization of the ICT sector is one of the first instances of the state-owned monopolies transitioning into private, competitive markets. As such, the mandate of ICT regulators often has been expanded to include the regulation of competition matters related to the telecommunications market. Under this expanded mandate, regulators are tasked with resolving complex issues related to competition laws without reference to any legal frameworks in the country. For example, the Kingdom of Bahrain does not have any general competition laws;[121] however, one of the main responsibilities of the Telecommunications Regulatory Authority (TRA) under the Telecommunications Law is to "promote effective and fair competition among new and existing Licensed Operators."[122] The Telecommunications Law requires the TRA to investigate instances where licensed operators are believed to engage in anti-competitive conduct, which requires the skills to analyze, for example, whether there has been abuse of dominant position, collusion or price fixing, or whether a merger would harm competition in the market.[123] Despite the lack of a general competition legal framework, the TRA has effectively introduced competition to each ICT market, including local and long distance fixed services, international gateways, mobile services and Internet services.[124]

1.5.2.2 Expanding cooperation among regulatory authorities

In countries that have general competition laws with agencies to govern these issues, the electronic communications or telecommunications law in many cases delegates to the ICT regulator the authority to issue rules and decisions related to competition in the ICT sector. The challenge in these countries is to ensure that concurrent jurisdiction between multiple agencies does not result in conflicting rules. Therefore, it is necessary that the country's laws provide guidance on how different regulatory authorities will cooperate in order to issue coherent, consistent and effective decisions. In addition, competition and ICT sector authorities often issue guidelines or publish memoranda of understanding on the exercise of their concurrent authority in competition related matters in the ICT sector to give legal certainty to stakeholders and avoid duplication and inefficient use of public resources. (See Box 1.12.)

In the United Kingdom, for example, the Office of Fair Trading (OFT) has the general power to enforce EU competition mandates and the country's Competition Act, but shares jurisdiction over certain sectors, including electronic communications, with the regulatory authorities of those sectors.[125] Before the Office of Communications (Ofcom) gained its full competition powers under the 2003 amendment to the Communications Act, OFT published a letter addressing the agencies' concurrent jurisdiction and providing an initial overview of how they should work together to "ensure a productive working relationship, to the benefit of consumers and other stakeholders."[126]

Box 1.12: Relevant issues for coordinating competition and ICT authorities' jurisdiction in the ICT sector

Taking into account the specific provisions of the legal framework, the following lists some issues that should be considered when establishing guidelines on the exercise of concurrent powers over competition matters in the ICT sector:

- Exchanging information to determine which authority has jurisdiction over a specific case;
- Determining which authority is better suited to exercise the concurrent powers in relation to a specific case;
- Resolving disputes as to which authority should exercise the concurrent powers in relation to a specific case;
- Preventing the simultaneous exercise by more than one than one authority of concurrent powers in relation to a specific case;
- Processes for transferring a case from one authority to another; and
- Sharing of staff and resources between authorities.

Source: Adapted from Office of Fair Trade (OFT) of the United Kingdom, Concurrent Application to Regulated Industries (December 2004)

The next year, OFT further clarified how authority is shared between the agencies through its guidelines, *Concurrent Application to Regulated Industries*.[127] Under OFT's guidelines, Ofcom may engage in most of the decision-making processes for competition-related issues, including investigating complaints about possible infringements under its jurisdiction; imposing financial penalties for violation of the competition rules in line with OFT's guidance; and publishing opinions in cases involving new or unresolved applications of the Competition Act.[128] However, as prescribed in the Competition Act, OFT alone has the authority to issue and to make and amend procedural rules.[129] Further provisions in the guidelines detail methods to ensure consistency in decision-making processes and outcomes between regulators, as well as with EU Directives and UK laws.

Developing countries have also sought to establish guidelines for cooperation and coordination of competition and ICT regulatory authorities. For example, in March 2010 the Competition Commission (CCM) and the Information and Communication Technologies Authority (ICTA) of Mauritius entered into a memorandum of understanding (MoU) on the exercise of their concurrent jurisdiction over the ICT sector.[130] The MoU establishes a set of guidelines to promote cooperation and coordination between the CCM and the ICTA when dealing with cases of anti-competitive behaviour in the ICT sector where they have overlapping powers; sets forth the responsibilities of both agencies in such matters; and establishes mechanisms for communication and sharing of information between CCM and ICTA with the aim of minimizing duplication of work and facilitating prompt and efficient resolution of cases.

1.5.3 Sector-Specific Approaches to Cooperation

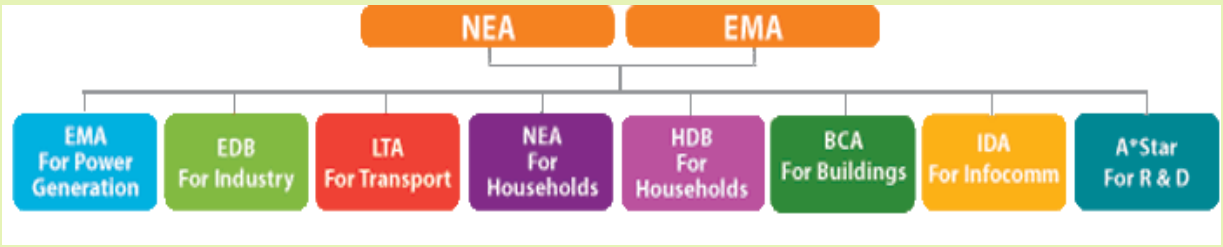
Unlike mandates regarding competition, telecommunications and electronic communications laws do not typically outline jurisdictional issues related to other sectors of the economy despite the influence of ICTs on these sectors. As addressed above, the confluence of ICTs with other sectors requires ICT regulators to be aware of the impact that their decisions have on other aspects of society, such as the environment, law enforcement, education, health and banking. As the influence of ICTs continues to grow, there may also be a need for provisions outlining the cooperative arrangements between the ICT regulator and other governmental agencies.

1.5.3.1 Cooperation between ICT regulators and environmental agencies

Traditionally, there has been limited overlap between the types of issues that the ICT regulatory authority and the environmental agency oversee, except regarding electromagnetic field (EMF) and radiofrequency field (RF) emissions from broadcasting and mobile communications towers or from handheld mobile devices. However, the growth of "green ICT" initiatives may require new levels of cooperation between the ICT and environmental regulators in order to accomplish ambitious cross-sector goals. Egypt, as previously discussed in Section 1.4.1.3, implemented its *Green ICT Strategy* jointly through a Memorandum of Understanding (MoU) signed by both the Ministry of Communications and Information Technology (MCIT) and the Ministry of Environmental Affairs (MEA) in February 2010.[131] Other countries have begun cross-sector coordination efforts in order to take a more holistic approach to meeting environmental and ICT policy objectives.

In Singapore, for example, multiple agencies have begun to collaborate more frequently on new cross-sector initiatives. In November 2009, for example, the government of Singapore announced the launch of the pilot project "Intelligent Energy System" (IES) that tests a range of smart grid technologies.[132] The IES project requires the cooperation of several agencies, including the ICT regulator and the various regulators in charge of energy, the environment, economic development, science and technology research, and housing and development. More recently, the Singapore Government established the Energy Efficiency Programme Office (E^2PO), which is a multi-agency committee led by the National Environment Agency (NEA) and the Energy Market Authority (EMA).[133] As shown in Figure 1.11 below, E^2PO includes Singapore's ICT regulator, the Infocomm Development Authority (IDA), as well as nine other agencies in various sectors. The goals of the E^2PO include promoting the adoption of energy efficient technologies and developing local knowledge expertise in energy management, as well as supporting research and development in green ICTs.

Figure 1.11: Ten Singapore agencies involved in the Energy Efficiency Programme Office, including ICT Regulator



Source: IDA Singapore.

Since cross-sector initiatives to promote green ICTs are relatively novel, it is unclear whether they represent a new type of policy implementation. There is great potential to capture the high-level expertise from multiple agencies; however, these collaborative efforts may also result in new challenges, such as jurisdictional conflicts or funding issues.

1.5.3.2 Cooperation between ICT regulators and law enforcement agencies

As previously addressed in Section 1.4.2, the number of crimes committed using communications networks, applications and services continues to grow in the digital age as more and more activities are conducted via electronic communications. Lawful interception of and access to electronic communications (e.g., wiretapping) has been a nexus between ICT regulators and law enforcement agencies (LEAs) for decades, first with the Public Switched Telephone Network (PSTN) and more recently with packet-switched and virtual networks. Although ICT regulators have begun to play a stronger role with respect to consumer protection issues such as spam, these laws have traditionally required LEAs, as well as defense or security agencies, to take the lead due to public safety and national security interests in issues including interception of communications, data privacy, cyber theft and fraud.[134]

However, due to its technical expertise, the ICT regulator's role in supporting or advising LEAs may increase in the digital age through 1) assisting LEAs in the coordination of various LEAs and national security agencies at local and national levels, and 2) assisting service providers and consumers in understanding their rights and obligations.[135] In some instances, the ICT regulator may take the lead in enforcing cybercrimes. For example, in the United Kingdom, the recently passed digital piracy law[136] places most of the implementation and enforcement powers with the ICT regulator, Ofcom, rather than with an LEA (see Box 1.13).[137] Where both LEAs and the ICT regulator are given authority over a particular area of cybercrime, the laws and enabling regulations should clearly define the roles of all parties, as well as provide adequate resources for enforcement.[138]

Box 1.13: Ofcom's expanded role in enforcing digital piracy law in the United Kingdom

- The Digital Economy Act of 2010 (DEA) assigned Ofcom new duties to create and to implement obligations regarding online copyright infringement.
- Ofcom, rather than a law enforcement agency, will enforce these obligations through a code of practice, which details a three-stage notification process for informing subscribers of infringements and requires ISPs to provide infringing subscribers' IP addresses to the relevant copyright holders.
- Ofcom's powers include deciding upon the appropriate enforcement action against any person found to have breached the code, including imposition and collection of a financial penalty up to £250,000.
- The DEA further requires Ofcom to establish an independent appeals tribunal for subscribers who have had copyright enforcement actions taken against them.

Source: Ofcom, Consultation on Online Infringement of Copyright and the Digital Economy Act 2010: Draft Initial Obligations Code

1.5.3.3 Cooperation between ICT regulators and education sector authorities

ICT regulators and education authorities are increasingly working together to facilitate deployment of e-learning and knowledge programs. Similarly, initiatives to forge alliances among private actors, donor agencies and non-governmental organizations have proven critical in implementing many successful initiatives to integrate ICT and education.

Afghanistan offers an example of how the Ministry of Education (MoE) and the Ministry of Communication and Information Technology (MoCIT) are collaborating on a project to improve both the education and ICT sectors.[139] Beginning in September 2008, the MoE and MoCIT launched a "One Laptop per Child" (OLPC) project in a public-private partnership with the United States Agency for International Development (USAID), Roshan, a mobile operator in Afghanistan, and Paiwastoon, a local information technology company. The MoE distributes the laptops to schools, and the MoCIT ensures the quality of the content, as well as the technology. By March 2010, more than 3,700 laptops had been distributed in Afghanistan through the OLPC project.[140]

As set out in Box 1.13 above, the ITU has developed a checklist of issues that should be considered by authorities when considering and implementing school connectivity initiatives.[141] Notably, the checklist highlights the need for school connectivity programs to be properly coordinated with the country's national plans and all the relevant agencies. In particular, school connectivity plans should be consistent with policies to promote overall ICT connectivity within the country. Within a national framework, school connectivity plans are best coordinated with policies, plans, strategies and programs for universal service, as well as broadband and digital and Information Society agendas. In addition, there must be a close coordination between the ministry responsible for education, the ministry responsible for ICTs, and the ICT regulator, to ensure that universal service funds and obligations are formulated within a plan for school connectivity that concretely describes the roles of all parties. Furthermore, the private sector and non-governmental organizations (NGOs) can play key roles in advancing school connectivity, and they should be invited to participate in the development of school connectivity plans.

1.5.3.4 Cooperation between ICT regulators and healthcare authorities

There are many areas in the medical field in which ICTs are improving health outcomes. These include significantly enhancing the collection, presentation and exchange of health care information, as well as by giving health care workers and patients tools to transform care. E-health initiatives include electronic records; long distance consultations via video conference; and mobile patient monitoring. As the number of e-health applications grows, ICT regulators and health care authorities will gain more opportunities to collaborate on new projects. In the U.S. National Broadband Plan, for example, the Federal Communications Commission (FCC) dedicated a chapter to e-health care. Included in the recommendations was a suggestion by the FCC to collaborate with the Food and Drug Administration (FDA), the agency that regulates medical devices, in order to "clarify regulatory requirements and the approval process for converged communications and health care devices."[142]

The successful use of ICTs for medical applications requires coordination between multiple agencies and ministries, potentially including not only telecommunications, but health, science, education and finance. ICT regulators need to work closely with partner agencies to develop mechanisms to enable the healthcare sector, including not only doctors and hospitals, but supporting institutions, schools, and research facilities, to effectively leverage the benefits of broadband connectivity. Key mechanisms and activities may include: subsidies or other financial support for communications networks to link key institutions; setting or identifying standards to enable interconnection between various stakeholders; developing or updating service rules governing electronic services used to share medical data; and provisions regarding privacy of data transmitted via such services. In expanding or improving access to health and medical services and information, ICT regulators may include incentives to ensure that recipients use subsidies or other assistance effectively and efficiently and for the benefit of patients or the medical sector as a whole.

1.5.3.5 Cooperation between ICT and banking regulators: m-Banking

ICT and financial sector regulators have distinct roles to play in enabling the development of m-Banking services, and coordination between them is critical. Although financial services are outside the purview of

telecommunications regulations, ICT regulatory authorities can encourage the development of the m-Banking market by working with their respective governments and forging new relationships with the financial services authorities in order to develop a framework that is appropriate for m-Banking services.[143]

In particular, ICT regulators should adopt policies to facilitate private investment and entry into the mobile telephony market. Development and expansion of mobile services leading to increased penetration are a precondition to providing a base for successful m-Banking services. Similarly, ICT regulators should enact and enforce rules – directly or in cooperation with competition authorities – to ensure competitive mobile markets. There is a risk that first mover advantages and specific marketing conditions of m-Banking services (e.g., lack of interconnectivity of m-Banking services[144] or differentiated fees between on-network and off-network transactions) may allow dominant mobile providers to further entrench their market positions. This outcome may not only restrict competition in the m-Banking market, but may also distort overall competitive conditions for mobile telephony services. For example, in August 2010, the Communications Commission of Kenya (CCK) raised a concern regarding the competitive effects of certain conditions associated with Safaricom's successful M-Pesa service.[145] It found that mobile money transfer services have a significant impact on the competitive landscape in the telecommunications market in Kenya as they allowed the strengthening and sustaining of a "club effect" since higher rates are charged to non-registered users versus non-registered users. Although the CCK did not regulate rates charged for mobile money transfers *ex ante*, it determined that it would support any operators' request to enter into an investigation of the interconnectivity options for mobile money transfer services in line with convergence, especially with regard to charges to non-registered users.

Banking regulators (e.g., central banks, finance ministries or banking regulatory authorities) also need to adapt traditional banking regulation to enable players involved in m-Banking (i.e., banks, mobile providers, and retailers) to develop new services, while at the same time protecting the stability of the financial system as a whole, the integrity of transactions, and the safety of customers' deposits.[146] (See Box 1.12.) While there is some international experience suggesting the viability of various m-Banking models, it is still too early for financial regulators to prescribe specific regulatory models.[147] For example, financial regulators in Afghanistan, the Philippines, West Africa and the European Union, have adopted regulations that enable a leading role for nonbanks, striking a balance between service availability and the need to mitigate the risks presented by the involvement of a service provider that is not subject to full prudential regulation.[148] On the other hand, a number of countries, such as Kenya and Cambodia, have not issued e-money regulations but have nevertheless permitted such nonbank models on an *ad hoc* basis through "no objection" letters, conditional approvals or other means.[149]

1.6 Conclusions

The ICT sector is highly dynamic and rapidly changing. Therefore, making predictions about what is to come in the next decade is very difficult. The deployment and take-up of ICTs, however, is happening at a faster pace than ever before, particularly with regard to the use of mobile services and applications in developing countries. This creates further challenges for regulatory authorities. Nevertheless, market and regulatory trends over the last few years demonstrate increased competition in ICT markets and evidence a continued and deepening path of convergence both within ICT sector as well as with other sectors of the economy. As such, the following conclusions can be drawn:

- As markets become more competitive, ICT regulators will need to shift to a more targeted approach to the sector, withdrawing *ex ante* regulation where it is no longer warranted and transitioning towards *ex post* rules. Development of strong competencies in the economic and legal techniques and methodologies for competitive analysis will be a critical input for regulators going forward. This will be particularly pressing in countries that have traditionally lacked competition laws and authorities or that have had a very limited scope of action. Accordingly, ICT regulators should engage in capacity building initiatives to develop the necessary institutional know-how and make efforts to increase cooperation with competition authorities where possible.
- Continued convergence within the ICT sector will present regulators with new challenges associated with vertical and horizontal integration of on-line services and applications. New players are progressively developing novel equipment, devices, services, applications and business models that have the potential of altering the ICT competitive landscape. However, when facing the challenges posed by nascent services and applications, regulators should exercise caution to avoid stifling innovation

and investment. A light-hand approach is oftentimes the right regulatory response under these circumstances and may contribute to creating an appropriate enabling environment for innovative services and applications to develop.

- Continued expansion of ICTs into our everyday activities will require ICT regulators to increase their cooperation with different regulators and policy-makers from different sectors, including law enforcement, education, banking, health and the environment. Increased coordination of policies and initiatives in these areas, and likely many others, will be critical in the coming decade to harness the potential benefits and efficiencies that ICTs can bring to consumers and the society at large.

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1 Yongsoo Kim, Tim Kelly and Siddhartha Raja, Building Broadband: Strategies and Policies for the Developing World, Global Information and Communication Technologies (GICT) Department, World Bank, January 2010 at www.infodev.org/en/Article.454.html.

2 Núcleo de Informação e Coordenação, *Análise dos Resultados da TIC Domicílios*, Gráfico 8, 2009, p. 14. The total percentage of respondents is more than 100 because some respondents provided more than one reason for non-adoption.

3 FCC, *Broadband Adoption and Use in America*, November 2009, p. 30. The total percentage of respondents is less than 100 because, for purposes of comparison, not all factors addressed in the study are included in this figure.

4 Morgan Stanley indicates that iPhone and iPod Touch users reached nearly 57 million by the ninth quarter since launch in June 2007, while AOL subscribers were at nearly 7 million by the same time after launch in September 1994. See Morgan Stanley, The Mobile Internet Report, 15 December 2009, p. 24.

5 ITU, World Telecommunication/ICT Development Report 2010, *Monitoring the WSIS Targets, A mid-term review*, May 2010, p. 198.

6 ITU World Telecommunication/ICT Indicators Database, Mobile cellular subscriptions.

7 ITU World Telecommunication/ICT Indicators Database, Mobile cellular subscriptions.

8 ITU, World Telecommunication/ICT Development Report 2010, *Monitoring the WSIS Targets, A mid-term review*, May 2010, p. 202.

9 See, e.g., ITU, The digital dividend: Opportunities and challenges, ITU News (January-February 2010) at www.itu.int/net/itunews/issues/2010/01/27.aspx and Björn Wellenius and Isabel Neto, Managing the Radio Spectrum: Framework for Reform in Developing Countries, (June 2007) at http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Wellenius-Neto.pdf.

10 YouTube reaches 2 bln views per day on 5th anniversary, 18 May 2010, www.telecompaper.com/news/article.aspx?cid=735195. According to YouTube, the average user spends 15 minutes a day on the website; 24 hours of video are uploaded to YouTube every minute; and 45 million daily homepage impressions.

11 Telegeography Research, January 2010.

12 EC, Europe's Digital Competitiveness Report, Vol. I, p. 22.

[13] The European Commission (EC) has called sites such as Google, Facebook, YouTube, Microsoft Live.com, Wikipedia, eBay23 and Amazon "global internet utilities" because they are so widely used in the world. See EC, Europe's Digital Competitiveness Report, Vol. I, 17 May 2010, p. 22.

[14] See *info*Dev/ITU, ICT Regulation Toolkit at www.ictregulationtoolkit.org/en/Section.1678.html.

[15] *Ibid.*

[16] See Next Generation Connectivity: A review of broadband Internet transitions and policy from around the world, The Berkman Center for Internet and Society at Harvard University (February 2010) at http://cyber.law.harvard.edu/publications/2010/Next_Generation_Connectivity and Dr. Tracy Cohen and Russell Southwood, Extending Open Access to National Fibre Backbones in Developing Countries, GSR08: Six Degrees of Sharing, Discussion Paper (November 2008) at www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR08/papers.html.

[17] See ITU/infoDev, ICT Regulation Toolkit, Module 6.6.5: Competition and Sharing at www.ictregulationtoolkit.org/en/Section.3486.html.

[18] FCC, National Broadband Plan, p. 41.

[19] Michael Minges, Crafting a Broadband Strategy for Developing Countries an Evidence-Based, Case Study Approach, Telecommunications Management Group, Inc. Presentation at the World Bank Broadband Strategy Toolkit: Information Session, 1 September 2010, Washington D.C. at https://docs.google.com/fileview?id=0BwCAk39OtgfRM2Q0OGViZGQtMjRkMC00YTQzLTk4MGItYzRmYjYwZWJlMzgx&hl=en&authkey=CKG61YIO.

[20] Cisco has estimated that smartphones such as the iPhone can generate 30 times more data traffic than a basic feature phone, and that a laptop can generate many times the traffic of a smartphone. *See* FCC, National Broadband Plan, p. 77.

[21] *info*Dev/ITU, ICT Regulation Toolkit, *Backbone Network Enhancements* at www.ictregulationtoolkit.org/en/Section.3188.html.

[22] Mark Williams, *Broadband for Africa: Policy for Promoting the Development of Backbone Networks*, GICT, World Bank, August 2008, p. 8 at http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Broadband_for_Africa-backbone_policy.pdf.

[23] Mark Williams, *Broadband for Africa: Policy for Promoting the Development of Backbone Networks*, GICT, World Bank, August 2008, p. 8.

[24] Mark Williams, *Broadband for Africa: Policy for Promoting the Development of Backbone Networks*, GICT, World Bank, August 2008, p. 15.

[25] FCC, National Broadband Plan, Appendix C, Glossary at www.broadband.gov/plan/appendices.html#s18-3.

[26] ICASA, Infraco ECNS Licence, October 2009 at www.infraco.co.za/Legal/ECNS%20License.pdf.

[27] Mark Williams, *Broadband for Africa: Policy for Promoting the Development of Backbone Networks*, GICT, World Bank, August 2008, p. 44.

[28] TeleGeography Global Bandwidth Research Service, 2010.

[29] See IDA, International Sharing: International Gateway Liberalization. Singapore's Experience, ITU, 2008.

[30] See TRAI, International Telecommunication Access to Essential Facilities at Cable Landing Stations Regulations, 7 June 2007.

[31] CRC, Resolution No. 2065, 27 February 2009.

[32] This member is a Special Purpose Vehicle (SPV) that is itself owned by a group of the smaller operators from the region. See Mark Williams, *Broadband for Africa: Policy for Promoting the Development of Backbone Networks*, GICT, World Bank, August 2008, p. 42.

[33] See www.seacom.mu/network/open_access.html.

[34] Abiodun Jagun, The Case for "Open Access" Communications Infrastructure in Africa: The SAT-3/WASC cable– A briefing, Association for Progressive Communications (APC) at www.apc.org/en/system/files/APC_SAT3Briefing_20080515.pdf.

[35] See KDN, SEACOM is here, at www.kdn.co.ke/contentview.php?id=38.

[36] For small island developing states (SIDS), obtaining submarine cable connectivity has been a mixture of geography, history and luck. Investment in a submarine cable depends on traffic which is itself a function of the number of people and the intensity of use. SIDS have very small populations and modest levels of teledensity and Internet usage making it challenging to obtain submarine cable connectivity. See, Ewan Sutherland, "Telecommunications in Small Island Developing States", 37th Research Conference On Communication, Information And Internet Policy September 25-27, 2009, George Mason University School of Law, p. 8.

[37] Sources: Adapted from ERG, Report on Transition from sector-specific regulation to competition law, October 2009; ICP-ANACOM, Mercados de fornecimento grossista de acesso (físico) à Infra-estrutura de rede num local fixo e de fornecimento Grossista de acesso em banda larga, January 2009.

[38] ERG, Report on Transition from sector-specific regulation to competition law, ERG (09) 40, October 2009, at 24.

[39] Michael Adam and Simon Alder, Abuse of Dominance and its Effects on Economic Development, in UNCTAD, The effects of anti-competitive business practices on developing countries and their development prospects, 2008, p. 587.

[40] Eleanor M. Fox, Antitrust, Economic Development and Poverty: The Other Path, in UNCTAD, The effects of anti-competitive business practices on developing countries and their development prospects, 2008, p. 184.

[41] See Article 55 of the COMESA Treaty (1994).

[42] See Article 88 of the UEMOA Treaty (Jan. 2003 Amendment), and Directive Nº 02/2002/CM/UEMOA relative a la coopération entre la Commission et les structures nationales de concurrence des États members pour l'application des articles 88, 89 et 90 du Traité de L'UEMOA.

[43] Protocol Amending the Treaty Establishing the Caribbean Community – Protocol VIII Competition Policy, Consumer Protection, Dumping and Subsides, Basseterre, St. Kitts and Nevis, 13-14 March 2000.

[44] See Decisión 608 of the Andean Community (March 2005).

[45] See Decisión nº 18/96, protocolo de defensa de la competencia and Decisión 02/97, Anexo al Protocolo de Defensa de la Competencia.

[46] Bahrain TRA, Competition Guidelines, MCD/02/10/019 (18 February 2010) at www.tra.org.bh/en/pdf/CompetitionGuidelines.pdf.

[47] See U.S. Federal Trade Commission, Statement of the Commission Concerning Google/AdMob, FTC File No. 101-0031, 21 May 2010. Available www.ftc.gov/os/closings/100521google-admobstmt.pdf.

[48] OECD, ICTs: The Environment and Climate Change at www.oecd.org/sti/ict/green-ict.

[49] *ITU Background Report*, ITU Symposium on ICTs and Climate Change, Quito, Ecuador (8-10 July 2009) at www.itu.int/dms_pub/itu-t/oth/06/0F/T060F00600C0004PDFE.pdf.

[50] UNEP defines this electronic waste, or e-waste, as "any electrically powered appliance that fails to satisfy the current owner for its originally intended purpose." UNEP, *e-Waste Management: What is e-waste?* at www.unep.fr/scp/waste/ewm/faq.htm.

[51] For an in-depth analysis of the roles that ICTs play in reducing, as well as contributing to, climate, please reference Stephen Young, , *ICTs, Climate Change and Regulation*, GSR-10 Discussion Paper (2010).

[52] *ICTs and Climate Change*, ITU-T Technology Watch Report 3 (December 2007).

[53] *ITU Background Report*, ITU Symposium on ICTs and Climate Change.

[54] *ITU Background Report*, ITU Symposium on ICTs and Climate Change.

[55] ITU, *ICTs for e-Environment: Guidelines for Developing Countries, with a Focus on Climate Change*, ICT Applications and Cybersecurity Division Policies and Strategies Department, Final Report (2008) at www.itu.int/ITU-D/cyb/app/docs/itu-icts-for-e-environment.pdf.

[56] ITU, *ICTs for e-Environment: Guidelines for Developing Countries, with a Focus on Climate Change*.

[57] ITU, *ICTs for e-Environment: Guidelines for Developing Countries, with a Focus on Climate Change*.

[58] O. Osibanjo, *The Challenge of Electronic Waste (E-Waste) Management in Developing Countries*, Waste Management & Research, Vol. 25, No. 6, 489-501 (2007).

[59] Tom Zeller, *A Program to Certify Electronic Waste Recycling Rivals an Industry-U.S. Plan*, N.Y. Times (14 April 2010) at www.nytimes.com/2010/04/15/business/energy-environment/15ewaste.htm.

[60] UNEP, Recycling—From E-Waste to Resources (July 2009) at http://isp.unu.edu/news_events/news/2010/files/UNEP_eW2R_publication.pdf.

[61] *Id.* See also *Hazardous E-Waste Surging in Developing Countries*, Science Daily (23 February 2010) at www.sciencedaily.com/releases/2010/02/100222081911.htm.

[62] Sweden, Ministry of Sustainable Development, *Ordinance on producer responsibility for electrical and electronic products* (14 April 2005) at www.regeringen.se/content/1/c6/04/70/12/c88be157.pdf.

[63] India, Ministry of Environment and Forests, *Draft E-Waste (Management and Handling) Rules* (2010) at www.indiaenvironmentportal.org.in/files/DraftE-waste-Rules30.3.10.pdf.

[64] Ministry of Economics, Trade and Industry, *Green IT Initiative in Japan* (October 2008) at www.meti.go.jp/english/policy/GreenITInitiativeInJapan.pdf.

[65] Ministry of Economics, Trade and Industry, *Green IT Initiative in Japan*.

[66] Ministry of Communications and Information Technology, *Green ICTs*, Press Release (10 August 2010) at www.mcit.gov.eg/pressKitsDetails.aspx?id=Az+07MRdz8k=.

[67] Ministry of Communications and Information Technology, *Dr. Kamel and Eng. George Sign Memorandum of Understanding on Green ICT Strategy*, Press Release (9 February 2010) at www.mcit.gov.eg/PressreleaseDetailes.aspx?id=soldypBGlXo=.

[68] OECD, *Towards Green ICT Strategies: Assessing Policies and Programmes on ICT and the Environment* (June 2009) at www.oecd.org/dataoecd/3/7/44001912.pdf.

[69] OECD, *Recommendation of the Council on Information and Communication Technologies and the Environment*, C(2010)61 (8 April 2010) at http://webnet.oecd.org/oecdacts/Instruments/ShowInstrumentView.aspx?InstrumentID=259&InstrumentPID=259&Lang=en.

[70] ITU-D, ICT Applications and Cybersecurity Division, *Understanding Cybercrime: A Guide for Developing Countries*, Draft (April 2009) at www.itu.int/ITU-D/cyb/cybersecurity/docs/itu-understanding-cybercrime-guide.pdf.

[71] The ITU Global Cybersecurity Agenda/High-Level Experts Group uses the same categorization. See www.itu.int/osg/csd/cybersecurity/gca/global_strategic_report/index.html.

[72] ITU-D, ICT Applications and Cybersecurity Division, *Understanding Cybercrime: A Guide for Developing Countries*.

[73] McAfee, *Unsecured Economies: Protecting Vital Information*, Report (2009) at http://resources.mcafee.com/content/NAUnsecuredEconomiesReport.

[74] ITU-D, ICT Applications and Cybersecurity Division, *Understanding Cybercrime: A Guide for Developing Countries*.

[75] ITU-D, ICT Applications and Cybersecurity Division, *Understanding Cybercrime: A Guide for Developing Countries*.

[76] International Federation of the Phonographic Industry (IPFI), *Digital Music Report* (2009) at www.ifpi.org/content/library/DMR2009.pdf.

[77] IPFI, *Digital Music Report* (2010) at www.ifpi.org/content/library/DMR2010.pdf.

78 *LOI n° 2009-669 favorisant la diffusion et la protection de la création sur internet* at www.culture.gouv.fr/culture/actualites/conferen/albanel/creainterenglish.pdf.

79 Eric Pfanner, *France Approves Wide Crackdown on Net Piracy*, The N.Y. Times (22 October 2009) at www.nytimes.com/2009/10/23/technology/23net.html.

80 David Landes, *Swedish Parliament Passes Copyright Bill*, The Local (25 February 2009) at www.thelocal.se/17832/20090225/.

81 U.K., *Digital Economy Act* (2010) at www.opsi.gov.uk/acts/acts2010/ukpga_20100024_en_1.

82 See European Commission, *Anti-Counterfeiting* at http://ec.europa.eu/trade/creating-opportunities/trade-topics/intellectual-property/anti-counterfeiting/. Also see U.S. Trade Representative, *ACTA: Summary of Key Elements* (April 2010) at www.ustr.gov/sites/default/files/uploads/factsheets/2009/asset_upload_file917_15546.pdf.

83 Council of Europe, Additional Protocol to the Convention on cybercrime, concerning the criminalisation of acts of a racist and xenophobic nature committed through computer systems, Strasbourg (28 January 2003) at http://conventions.coe.int/Treaty/en/Treaties/Html/189.htm.

84 See the First Amendment of the U.S. Constitution.

85 ITU-D, ICT Applications and Cybersecurity Division, *Understanding Cybercrime: A Guide for Developing Countries*.

86 ITU, *Enlightened ICT regulation Can Play the Role of 'Stimulus Plan'*, Press Release (March 2010) at www.itu.int/net/pressoffice/press_releases/2010/12.aspx.

87 Joel Schwartz, *International Cooperation in Cybercrime Investigations, Computer Crime and Intellectual Property Section*, U.S. Department of Justice (November 2007) at www.itu.int/ITU-D/cyb/events/2007/praia/docs/schwarz-international-cooperation-praia-nov-07.pdf.

88 Howard Rush, Chris Smith, Erika Kraemer-Mbula and Puay Tang, *Crime Online: Cybercrime and Illegal Innovation*, Research Report, University of Brighton, U.K. (July 2009) at http://eprints.brighton.ac.uk/5800/01/Crime_Online.pdf.

89 ITU-D, ICT Applications and Cybersecurity Division, *Understanding Cybercrime: A Guide for Developing Countries*.

90 *info*Dev, *Survey of ICT and Education in Africa: A Summary Report Based on 53 Country Surveys*, p. 6, www.infodev.org/en/Document.353.pdf.

91 These countries are: Anguilla, British Virgin Islands, Dominica, Grenada, St. Lucia, and St. Vincent and the Grenadines. See Edmond Gaible, Survey of ICT and Education in the Caribbean: A summary report, Based on 16 Country Surveys, *info*Dev / World Bank (2009), p. 29 at www.infodev.org/en/Publication.441.html.

92 Some countries, like Uruguay, have developed centralized policies to promote school connectivity. Others, such as India, have adopted a more decentralized approach toward achieving this goal –with both national and state initiatives being implemented. For a review of the major national and regional initiatives for ICT in education in India, see *info*Dev, Information and Communication Technology for Education in India and South Asia, Volumes II and III, Country Case Studies (2010), at www.infodev.org/en/Project.103.html.

93 In October 2009, the ITU launched *Connect a School, Connect a Community,* a public-private partnership promote broadband Internet connectivity for schools in developing countries around the world.[93] The objective of this initiative is that children and youth attending connected schools will have improved access to the latest ICTs. In addition, connected schools are expected to leverage ICTs to improve the economic and social development of their communities, serving as hubs to provide ICT-based training on basic life skills (*e.g.,* language literacy, numeracy and basic ICT literacy) and tools to develop business and ICT-specialized skills.

94 *See* Centro de Educación y Tecnología (Enlaces), Ministerio de Educación, at www.enlaces.cl/index.php?t=44&i=2&cc=1273&tm=2.

95 *info*Dev, Information and Communication Technology for Education in India and South Asia, Volume I, Extended Summary.

96 See Jorge M. Pedreira. "Technological plan for education: The Portuguese framework for ICT in education and the Magellan initiative for primary school children." Presented at Inter-American Development Bank Seminar on "Reinventing the Classroom",

15 September 2009. Washington D.C. http://events.iadb.org/calendar/eventDetail.aspx?lang=En&id=1444; and www.tmn.pt/kids/#/e-escolinhas/magalhaes/.

97 Ana Laura Martínez, Serrana Alonso and Diego Díaz, Monitoreo y evaluación de impacto social del Plan CEIBAL. Metodología y primeros resultados a nivel nacional (Dec. 2009) at www.ceibal.org.uy/docs/presentacion_impacto_social221209.pdf.

98 Different strategies such as refurbishing computers (*i.e.,* recycling computers generally donated to the school connectivity programs) or using a "thin-client" approach (*i.e.,* in which a simple computer (the "client") is connected to a server that carries out most of the processing).

99 See Toolkit for breakdown of costs

100 See Tasa de alumnos por PC, at www.enlaces.cl/index.php?t=44&i=2&cc=800&tm=2.

101 See ITU, Connect a School, Connect a Community, Module 1: Policies and Regulation to Promote School Connectivity (2009). LCCD projects, on the other hand, are usually a collaboration between the ministry of education and other partners such as NGOs, international donors and the private sector. As such, the role of ICT regulators in LCCD projects is usually more limited.

102 WHO, *Global Survey for eHealth* (2005) at www.who.int/goe/data/en/.

103 WHO, *World Health Statistics 2010* at www.who.int/whosis/whostat/2010/en/index.html.

104 ITU, Implementing e-Health in Developing Countries: Guidance and Principles (Draft), p. 11 (2008) at www.itu.int/ITU-D/cyb/app/docs/e-Health_prefinal_15092008.PDF.

105 See Rodrigue Rwirahira, *Rwanda: Better Health Care By Using ICT in Medicine*, All Africa (28 August 2009) at http://allafrica.com/stories/200908280497.html.

106 Moses Ndahiro, RDB Forging Ahead with E-Health Development, The New Times (20 September 2010) at www.newtimes.co.rw/index.php?issue=13963&article=17756.

107 Gautam Ivatury and Ignacio Mas, *The Early Experience with Branchless Banking*, Consultative Group to Assist the Poor (CGAP) (April 2008) at www.cgap.org/gm/document-1.9.2640/FN46.pdf.

108 Christopher P. Beshouri and Jon Gravråk, *Capturing the Promise of Mobile Banking in Emerging Markets*, McKinsey Quarterly (February 2010) at www.mckinseyquarterly.com/Capturing_the_promise_of_mobile_banking_in_emerging_markets_2539.

109 The unbanked are "customers, usually the very poor, who do not have a bank account or a transaction account at a formal financial institution." See GSMA, *Mobile Money Definitions* (July 2010) at http://mmublog.org/uncategorized/mobile-money-terminology/.

110 *Mobiles for Development: The Case for M-Banking* , CGAP (November 2006) at www.cgap.org/publications/mobilephonebanking.pdf.

111 Timothy R. Lyman, Mark Pickens, and David Porteous, *Regulating Transformational Branchless Banking: Mobile Phones and Other Technology to Increase Access to Finance*, CGAP Focus Note No. 43 (January 2008) at www.cgap.org/gm/document-1.9.2583/FN43.pdf.

112 Claire Alexandre, Ignacio Mas and Dan Radcliffe, *Regulating New Banking Models that can Bring Financial Services to All*, Bill & Melinda Gates Foundation (August 2010) at www.microfinancegateway.org/gm/document-1.9.46229/Regulating%20New%20Banking%20Models82010.pdf.

113 Paul Leishman, *A Closer look at 'ZAP' in East Africa*.

114 Consultative Group to Assist the Poor (CGAP), *Poor People Using Mobile Financial Services: Observations on Customer Usage and Impact from M-PESA*, Report (August 2009) at www.cgap.org/gm/document-1.9.40599/FN57.pdf.

115 CGAP, *Poor People Using Mobile Financial Services: Observations on Customer Usage and Impact from M-PESA*, Brief (August 2009) at www.cgap.org/gm/document-1.9.36723/BR_Poor_People_Using_Mobile_Financial_Services.pdf.

116 Telenor, *Telenor Pakistan's easypaisa – The mobile banking solution*, July 2010. Document on file with author.

117 See Resolution SBS N° 775-2008.

[118] SBS and CAGP, *Financial Inclusion and Consumer Protection in Peru: The Branchless Banking Business,* Joint Assessment Report (February 2010) at www.cgap.org/gm/document-1.9.41601/Financial%20Inclusion%20and%20Consumer%20Protection%20in%20Peru%20The%20Branchless%20Banking%20Business.pdf.

[119] *SBS to Introduce New Regulation to Allow M-Banking Services*, BN Americas (10 May 2010) at www.bnamericas.com/story.xsql?id_sector=2&id_noticia=517262&Tx_idioma=I&source=.

[120] *SBS to Issue New Regulations to Allow Mobile Banking*, BN Americas (7 May 2010).

[121] See World Bank, *Competition Law Database* at http://go.worldbank.org/40X7UQLL90.

[122] Telecommunications Law of the Kingdom of Bahrain, Legislative Decree No. 48 of 2002 at www.tra.org.bh/en/pdf/TelecommunicationsLaw-secondedition-English.pdf.

[123] Telecommunications Law of the Kingdom of Bahrain, Legislative Decree No. 48 of 2002 at www.tra.org.bh/en/pdf/TelecommunicationsLaw-secondedition-English.pdf.

[124] See ITU, ICT EYE Database, Regional Reports, Level of Competition (2009) at www.itu.int/ITU-D/ICTEYE/Regulators/Regulators.aspx#.

[125] United Kingdom, Competition Act of 1998, Schedule 10 at www.opsi.gov.uk/acts/acts1998/plain/ukpga_19980041_en.

[126] OFT, *Letter from the Office of Fair Trading (OFT) Setting Out OFT/Ofcom Concurrency Arrangements* (December 2003) at www.ofcom.org.uk/about/accoun/oft/#content.

[127] OFT, *Concurrent Application to Regulated Industries* (December 2004) at www.oft.gov.uk/shared_oft/business_leaflets/ca98_guidelines/oft405.pdf.

[128] OFT, *Concurrent Application to Regulated Industries*, Sec. 2.4 (December 2004).

[129] OFT, *Concurrent Application to Regulated Industries*, Sec. 2.5 (December 2004).

[130] Memorandum of Understanding between the Competition Commission of Mauritius (CCM) and the Information and Communication Technologies Authority (ICTA), (March 2010) at www.ccm.mu/mouICTA.pdf

[131] Ministry of Communications and Information Technology, *Dr. Kamel and Eng. George Sign Memorandum of Understanding on Green ICT Strategy*, Press Release (9 February 2010) at www.mcit.gov.eg/PressreleaseDetailes.aspx?id=soldypBGlXo.

[132] Energy Market Authority, Singapore's Intelligent Energy System Pilot Project: First Step towards a Smarter Grid (November 2009) at www.ema.gov.sg/ema_cms/media/news_pdfs/1260266179IES%20Press%20Release%20_Final_%20web.pdf.

[133] E^2Singapore, Energy Efficient Program Office at www.e2singapore.gov.sg/energy-efficiency-programme-office.html#.

[134] Eric Lie, Rory Macmillan & Richard Keck, *Draft Background Paper on Cybersecurity: The Role and Responsibilities of an Effective Regulator*, GSR-09 (October 2009) at www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR09/doc/GSR-background-paper-on-cybersecurity-2009.pdf.

[135] Eric Lie, Rory Macmillan & Richard Keck, *Draft Background Paper on Cybersecurity: The Role and Responsibilities of an Effective Regulator*, GSR-09 (October 2009) at www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR09/doc/GSR-background-paper-on-cybersecurity-2009.pdf.

[136] Digital Economy Act 2010 (c. 24) at www.legislation.gov.uk/ukpga/2010/24/contents.

[137] Ofcom, *Consultation on Online Infringement of Copyright and the Digital Economy Act 2010: Draft Initial Obligations Code* (May 2010) at http://stakeholders.ofcom.org.uk/binaries/consultations/copyright-infringement/summary/condoc.pdf.

[138] An in-depth analysis on this topic has been developed in the GSR10 Discussion Paper "The role of ICT regulation in addressing cyberthreats", at: www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR10/documents/documents.html.

[139] OPLC, *One Laptop per Child in Afghanistan* (April 2009) at http://olpc.af/index.php/component/content/article/35-olpc-in-afghanistan-/8-olpc-in-afghanistan-.html.

[140] OLPC, *OLPC Breaks New Ground in Kandahar* (March 2010) at http://blog.laptop.org/2010/03/09/olpc-provides-children-of-afghanistan-access-to-a-modern-education/.

[141] See ITU, Connect a School, Connect a Community, Module 1: Policies and Regulation to Promote School Connectivity (2009). LCCD projects, on the other hand, are usually a collaboration between the ministry of education and other partners such as NGOs, international donors and the private sector. As such, the role of ICT regulators in LCCD projects is usually more limited.

[142] FCC, National Broadband Plan, Ch. 10 Health Care at www.broadband.gov/plan/10-healthcare/#r10-1.

[143] Christopher P. Beshouri and Jon Gravråk, *Capturing the Promise of Mobile Banking in Emerging Markets*.

[144] See James Bellis and Lasse Nagel, *Interoperability of Mobile Money* Services, GSMA Mobile Money for the Unbanked Annual Report 2009, at www.gsmworld.com/documents/mmu_2009_annual_report.pdf.

[145] Sources: CCK, Interconnection Determination No.2 of 2010, Determination on interconnections rates for fixed and mobile telecommunications networks, infrastructure sharing and co-location; and broadband interconnection services in Kenya; Gunnar Camner, Caroline Pulver and Emil Sjöblom, What Makes a Successful Mobile Money Implementation? Learnings from M-PESA in Kenya and Tanzania, GSMA. Olga Morawczynski and Mark Pickens, Poor People Using Mobile Financial Services: Observations on Customer Usage and Impact from M-PESA, CGAP Brief (August 2009) at www.cgap.org/gm/document-1.9.36723/BR_Poor_People_Using_Mobile_Financial_Services.pdf.

[146] Claire Alexandre, Ignacio Mas and Dan Radcliffe, *Regulating New Banking Models that can Bring Financial Services to All*, Bill & Melinda Gates Foundation (August 2010) at www.microfinancegateway.org/gm/document-1.9.46229/Regulating%20New%20Banking%20Models82010.pdf.

[147] Ibid.

[148] Michael Tarazi and Paul Breloff, *Nonbank E-Money Issuers: Regulatory Approaches to Protecting Customer Funds*, CGAP Focus Note No. 63 (July 2010) at www.cgap.org/gm/document-1.9.45715/FN63_Com.pdf.

[149] Ibid.